RAILROAD GAZETTE

QUARTO VOL. IX.—NO. 10. TWENTIETH YEAR.

A Journal of Transportation, Engineering and Railroad News.

$4.20 PER ANNUM, POSTAGE FREE.

NEW YORK: 73 Broadway. FRIDAY, MARCH 9, 1877. CHICAGO: 77 Jackson St.

S.N. Keith Box 409 Conn.

JUST PUBLISHED:

"RAILWAY DISBURSEMEN
And the Accounts into which they are Naturally Divided."

By MARSHALL M. KIRKMAN.

This work is intended to give full and minute instructions for the guidance of those agents and employes of railroad companies who may be entrusted with the disbursing of the money or material of the corporation, in such manner as to insure the strict accounting for everything, leaving no loop-holes for undetected waste or wrongful appropriation of the company's property.

The book consists chiefly of formal rules, illustrated by forms of the blanks recommended and referred to. These rules are the result of many years' experience, most of them having been practically applied and amended from time to time as seemed advisable to make them thoroughly effective and perfectly clear. It is believed that they will be, for the most part at least, found applicable on all American railroads, and can be issued as instructions to employes accordingly.

The most complete and exact rules for keeping railroad accounts ever published. Price $2, postage paid. Published by the RAILROAD GAZETTE, 73 Broadway, New York.

GEORGE A. EVANS,
Bethlehem Steel Rails,
74 WALL STREET, N. Y.

RAILWAY SAFETY APPLIANCES.

INTER-LOCKING SYSTEM.

CAUTION.

Whereas, in the year 1856, Letters Patent were granted in England to John Saxby for his original invention of Locking Apparatus to prevent accidents at Junctions; and whereas the said John Saxby, together with John Stinson Farmer, trading under the style or firm of Saxby & Farmer, as Railway Signalling Engineers and Manufacturers, in London, England, are the sole proprietors of the said patent, as well as of several other English patents subsequently granted to them for improvements; and whereas they were the first to introduce the inter-locking system in America, and are now the sole proprietors of three several United States Patents granted to them for such improvements, as well as of a pateut granted to John Imray for further improvements; which patents are of number and date as follows, viz.:

United States Patent No. 80,978 August 11, 1868,
" " 131,788 October 1, 1872.
" " 132,416 " 22, 1872
" " 169,811 Nov. 9, 1875, and

whereas of late various Signalling Apparatus have been advertised or made, which are infringements of the above or of some or one of the above-mentioned United States Patents,

All persons and compahies are hereby cautioned against making, vending, or using any such Signalling Apparatus which are infringements of the before-mentioned patents or some or one of them; and notice is hereby given that they will be held responsible for any such infringements.

SAXBY & FARMER,
Railway Signalling Engineers.
LONDON, N. W.

GEORGE WESTINGHOUSE, JR., PRESIDENT. RALPH BAGALEY, SEC'Y & TREASUER. T. W. WELSH, SUPERINTENDENT

THE WESTINGHOUSE AIR-BRAKE COMPANY,
PITTSBURGH, PA., U. S. A.,
Manufacturers of the
WESTINGHOUSE AUTOMATIC BRAKE.
WESTINGHOUSE LOCOMOTIVE DRIVER BRAKE.
VACUUM BRAKES (Westinghouse & Smith Patents).
WESTINGHOUSE AIR BRAKE.

Particular attention is called to the "AUTOMATIC" and "LOCOMOTIVE DRIVER BRAKES," now being tested and adopted by the prominent lines.

With the "DRIVER BRAKE" the engineer can handle an ordinary freight train better than with brakemen. The saving in car wheels and wages will therefore be apparent. On shifting or yard engines it is invaluable.

The "AUTOMATIC" has proved itself to be the most efficient train and safety brake known. Its application is instantaneous; it can be operated from any car in the train, if desired, and should the train separate, or a hose or pipe fail, it applies automatically. A GUARANTEE is given customers against LOSS from PATENT SUITS on the apparatus sold them.

FULL INFORMATION FURNISHED ON APPLICATION.

WM. J. NICOLLS, Civil Engineer,
Manufacturers' Agent and Broker,
5 POST OFFICE AVENUE, BALTIMORE, MD.,
Railroad Supplies a Specialty.

JOHN A. WILSON, Civil Engineer. JOS. M. WILSON, Architect. Civil Engineer and Architect.
WILSON BROTHERS & CO.,
Civil Engineers and Architects.
410 Walnut St. Philadelphia, Pa.
Surveys and estimates made for railway lines.
Plans, specifications and estimates furnished for roofs, bridges, stations, machine shops, engine houses, hotels, dwellings and all engineering and architectural structures. Construction of engineering and architectural works attended to.

THE SAFE DEPOSIT CO.
OF NEW YORK.
140, 142 and 146 Broadway.
FRANCIS H. JENKS, President.
☞ The First Established in the World.
For the safe-keeping of Valuables, Bonds, Stocks, Plate, Jewelry, Wills, etc., (at $1 a year for $1,000 of Bonds), and the renting of Safes (at from $15 to $200 a year), in its fire and burglar proof vaults.
ROOMS FOR LADIES,
with every convenience, separate desks, etc., are provided.

"LOUGHRIDGE AIR BRAKE,"
Adopted by the Balt. & Ohio, W. Md. C. & Pa. (with Mountain grades of 182 feet to the mile), St. L., L. & W. in Kansas and others. It has been used on a thousand or more cars long enough to convince the most incredulous that it is the best. The best stop yet accomplished in the world with air brakes was made with this practical invention on the B. & Ohio R. R. The train weighed 250 tons and consisted of ten cars, speed 42 6-10 miles per hour; time in stopping, 16 seconds; distance run, 587 8-12 feet. It is capable of much better results now. Cheap in construction and repair, of but few and simple parts, uniform and reliable in action, quick to apply and relieve the brakes, and accomplishes all desirable ends required in running trains that competing brakes do. For further information address, WILLIAM LOUGHRIDGE, P. O. Box 441. Office Morse Building, Room 17, Baltimore, Md.

CLEMENS HERSCHEL, Civ. Eng.
IRON AND OTHER BRIDGES AND ROOFS A SPECIALTY.
No. 66 State Street, Boston, Mass.
Mr. Herschel will refer, if desired, to finished bridges or roofs designed by him or built under his superintendence; to his services as a Bridge Commissioner; to his book on "Continuous Revolving Draw-Bridges." Can also give many and eminent personal references.

100 LOCOMOTIVES,
of the best makers, nearly new, 30 tons, 16×24,
TO LEASE,
on temporary or permanent leases, at low rates, by
THE UNITED STATES ROLLING STOCK CO., 76 Wall Street, New York.
A. HEGEWISCH, Treasurer and Secretary.

RAILWAY ECONOMY
And Security.
Hall's Automatic Electric Railway Signal System.
Best in the World.
THE HALL RAILWAY SIGNAL COMPANY.
THOMAS S. HALL, Gen'l Manager,
West Meriden, Conn.

W. CALHOUN, E. G. STEELE,
ACCOUNTANTS & AUDITORS,
No. 20 Nassau Street.
Complicated accounts of Estates and Partnerships investigated and adjusted. Accounts prepared for the Surrogate. Books of Public Companies, Firms, etc., opened, written up or closed.
Special attention given to Railroad investigations in any part of the United States or Canada.
REFERS BY PERMISSION TO
Geo. S. Coe, Esq., Pres't American Exch'ge Bank.
W. A. Wheelock, Esq., Pres't Central Nat. Bank.
Jas. Lynch, Esq., Pres't Irish Emigrant Society.
Col. H. S. McComb, Pres't N. O., St. L. & C. R. R.
Ex. Norton, Esq., Pres't Paducah & Mem. R R. Co.
Jos. F. Joy, Esq., Receiver Dutchess & Col. R. R.
Parker Handy, Esq., Banker.
H. W. Smithers, Esq., Agent.
Hon. H. A. Smythe, late Collector of Port of N. Y.
Hon. Jas. P. Sinnott, Judge of the Marine Court.
Messrs. Van Winkle, Candler & Jay, Counsellors.

RAILROAD IRON.
50 and 56 lbs. in store at New Orleans.
50 and 56 lbs. in store at New York.
Bessemer Steel Rails.
46, 56 and 60 lbs. in store at New York.
For sale by
DANA & COMPANY,
20 Nassau street.

J. S. KENNEDY & CO.,
BANKERS AND MERCHANTS,
41 CEDAR, CORNER WILLIAM STREET,
New York,
Buy and sell Railroad Investment Securities, Collect Coupons and Dividends, Negotiate Loans and draw Bills of Exchange on London.
Agents of the
CAMBRIA IRON COMPANY,
of JOHNSTOWN, Pa., for the sale of their IRON and STEEL RAILS.
All business relating to the Construction and Equipment of Railroads undertaken.

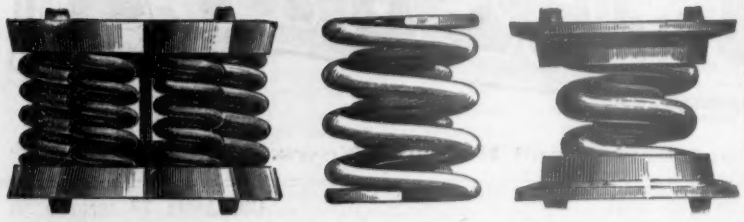
RAILROAD GAZETTE DIRECTORY.

[This index to the advertisements in the RAILROAD GAZETTE is published in order that they may be more convenient and valuable to those who make use of them as a directory of railroad supplies and equipment. A number of advertisements appear only "every other week" or "once a month;" in such cases, where the advertisement is not in the current number, a blank appears instead of the folio opposite the name.]

Accountants:
Calhoun & Steele, 20 Nassau street, N. Y.. i
Air Brakes:
Wm. Loughridge, Baltimore i
Westinghouse Air-Brake Co., Pittsburgh i
Axles:
A. & P. Roberts & Co., Philadelphia v
Wilson Walker & Co., Pittsburgh ii
Boiler Punches:
I. P. Richards, Providence, R. I. xiv
Bolts, Nuts, Boiler Rivets, etc.:
Rogers & Townsend, Philadelphia vii
Bridges:
American Bridge Co., Chicago iv
Baltimore Bridge Co., Baltimore iv
Cincinnati Bridge Co., Cincinnati iv
Clark, Reeves & Co., Philadelphia v
J. H. Cotrode & Co., Detroit v
Delaware Bridge Co., 52 Wall street, N. Y. iv
Detroit Bridge & Iron Works, Detroit iv
Edgemoor Iron Co., Wilm. & 79 Liberty st., N. Y. v
G. W. James & Co., Milwaukee, Wis. iv
S. S. Hopkins & Co., St. Louis iv
Kellogg & Maurice, Athens, Pa iv
King Iron Bridge & Manufacturing Co., Cleveland. iv
Keystone Bridge Company, Philadelphia iv
Leighton Bridge & Iron Works, Rochester v
Lowthorp & Henderson, Trenton, N. J. v
Louisville Bridge & Iron Co., Louisville iv
Niagara Bridge Works, Buffalo v
Wrought-Iron Bridge Co., Canton, O. v
Bridge Bolts:
Hotchkiss & Gaylord, Cleveland vi
Cars:
Barney & Smith, Manufacturing Co., Dayton, O. viii
J. G. Brill & Sons, Philadelphia xii
Harlan & Hollingsworth Co., Wilmington xii
J. R. Jones & Co., West Troy xii
Terre Haute Car & Mfg. Co. vii
Car Heaters and Stoves:
Baker, Smith & Co., New York viii
Gardner Chilson, Boston xiv
Car Wheels:
Baltimore Car-Wheel Co., Baltimore iii
Barnum Richardson Co., Lime Rock, Conn. iii
Barnum & Richardson Manufacturing Co., Chicago. iii
Bowler, Maher & Brayton, Cleveland viii
Bayers Wheel & Foundry Co., Waverly, N. Y. viii
Boston Manufacturing Co., Huntington, West Va. iii
John L. Gill, Columbus, O. viii
Hamilton Steeled-Wheel Co., Philadelphia ix
Lobdell Car-Wheel Co., Wilmington, Del. ii
Louisville Car-Wheel & Ry. Supply Co. Louisville. viii
McKee & Fuller, Catasauqua, Pa. iii
Thomas May & Co., Indianapolis ii
Mowry Car & Wheel Co., Cincinnati viii
Ramapo Wheel & Foundry Co., Ramapo, N. Y. iii
Taylor Iron Works, High Bridge, N. J. ii
A. Whitney & Sons, Philadelphia iii
Cedar Tanks:
Geo. J. Burkhardt, Philadelphia, Pa. vii
Checks:
John Robbins, Boston ix
Civil Engineers:
Clemens Herschel, Boston i
W. J. Nicolls, Baltimore i
R. E. Ricker & Co., New York xiv
Wilson Bros. & Co., Philadelphia i
Cordage:
Elizabethport Steam Cordage Co., N. Y. v
Cushioned Helve Hammers:
Bradley Manufacturing Co., Syracuse vii
Drilling Machines:
Thorne, DeHaven & Co., Philadelphia xii
Duplex Tickets:
American Duplex Ticket Co., 860 Broadway, N. Y. viii
Employment ix
Encyclopedia:
Zell, Davis & Co., Philadelphia ix
Engineering Instruments:
Buff & Berger, Boston xiv
Heller & Brightly, Philadelphia xiv
W. Kuebler, Philadelphia, Pa. xiv
James Prentice, 164 Broadway, N. Y. xiv
W. J. Young & Sons, Philadelphia xiv
Excavators:
S. B. Alger, Long Island City, N. Y. ii
John Souther & Co., Boston ii
Files:
G. & H. Barnett, Philadelphia xii
For Sale —
Frogs and Crossings:
H. & H. Elliott, E. St. Louis, Ill. vi
Seamless Steel Ware & Frog Co., Harrisburg ix
Hoisting Engines:
Copeland & Bacon, New York vii
Hotels:
The Brunswick, Boston vii
Hydraulic Jacks:
Richard Dudgeon, 24 Columbia st., N. Y. vii
Philip S. Justice, Philadelphia vii
McCoy & Co., 134 Duane st., N. Y. —
Injectors:
National Tube Works Co., Boston —
Wm. Sellers & Co., Phila. & 79 Liberty st., N. Y. xiv
Iron Work for Contractors:
Edgemoor Iron Co., Wilm. & 79 Liberty st., N. Y. v
Iron Buildings:
Schweizer & Gruwe, 71 Broadway, N. Y. vi
Journal Bearings:
Geo. R. Meneely & Co., West Troy, N. Y. viii
C. J. A. Dick, Philadelphia x
Locomotives:
Baldwin Locomotive Works, Philadelphia viii
Brooks Locomotive Works, Dunkirk, N. Y. vi
Danforth Loco. & Mach. Co., Paterson, N. J. xi
Dickson Mfg. Co., Scranton, Pa. xi
Hinkley Locomotive Works, Boston xi
Manchester Loco. Works, Manchester, N. H. xi
Mason Machine Co., Taunton, Mass. x
National Loco. Works, Connellsville, Pa. xi
Pittsburgh Loco. & Car Works, Pittsburgh xi
Porter, Bell & Co., Pittsburgh xi
Rogers Loco. & Machine Works, Paterson, N. J. xi
Schenectady Loco. Works, Schenectady, N. Y. xi
Taunton Loco. M'f'g Co., Taunton, Mass. xi
Locomotives to Lease:
U. S. Rolling Stock Co., 74 Wall st., N. Y. i
Locomotive Balances:
T. S. Morton, 65 Elizabeth st., N. Y. —
Lubricators:
C. H. Parshall, Detroit vi
Machinists' Tools:
W. B. Bement & Son, Philadelphia vi
Ferris & Miles, Philadelphia ix
E. Harrington & Son, Philadelphia x
Wm. Sellers & Co., Phila. & 79 Liberty st., N. Y. xiv
Mortising Machines:
Lane & Bodley, Cincinnati ix
Paint:
Iron-Clad Paint Co., Cleveland, O. ix
E. Maxwell & Co., St. Louis ix
Prince's Metallic Paint Co., 225 Pearl st., N. Y. vi
Rogers & Co., Fort Wayne —
Quick-Stop Train Brake
Wm. Loughridge, Baltimore. i
Rails:
Albany & Renss. Iron & Steel Co., Troy, N. Y. x
Cambria Iron Co., Johnstown, Pa. x
Cleve. Rolling Mil. Co, Cleveland, O. x
Dana & Co., 20 Nassau st., N. Y. i
Edgar Thomson Steel Co., Pittsburgh x
Geo. A. Evans, 74 Wall st., N. Y. i
North Chi. Rolling Mill Co., Chicago. x
Springfield Iron Co., Springfield, Ill. x
Rail Fastenings:
American Ry. Supply Co., Pittsburgh v
Atwood Con. Lock Nut M'f'g Co., 40 Broadway, N. Y. v
Fisher & Norris, Trenton, N. J. vii
Loomis Nut-Lock Washer Co., Cleveland v
Railroads and Transportation Lines:
Atlantic & Great Western xii
Baltimore & Ohio xiii
Chicago & Alton xiii
Chicago, Milwaukee & St. Paul xiii
Chicago & Northwestern xiii
Chicago, Rock Island & Pacific xiii
Cleveland, Col., Cinn. & Indianapolis xii
Erie Railway Co. xii
Empire Transportation Co. xii
General Transatlantic Co. xii
Illinois Central xiii
Michigan Central xiii
New York Central & Hudson River xii
New York and New England xii
North Pennsylvania xii
Pennsylvania xii
Philadelphia & Reading xii
Philadelphia, Wilmington & Baltimore xiii
Union Pacific xii
Wisconsin Central xiii
Railroad Land Companies:
A. N. Kellogg, Chicago —
Railroad Manuals:
H. V. & H. W. Poor, 68 Broadway, N. Y. —
Railroad Securities:
J. S. Kennedy & Co., 4 Cedar st., N. Y. i
Railroad Car Brake:
Wm. Loughridge, Baltimore. i
Railway Signals:
Saxby & Farmer, London i
Rubber Goods:
Hamilton Rubber Co., Trenton, N. J. ii
Rubber-Step Manufacturing Co., Boston ii
Safe Deposit:
Safe Deposit Co., 140 Broadway, N. Y. i
Sash Chains:
T. S. Morton, 65 Elizabeth st., N. Y. —
Shafting:
Wm. Sellers & Co., Phila. & 79 Liberty st., N. Y. xiv
Signals:
Hall Ry. Signal Co., West Meriden, Ct. i
Spikes:
Dilworth, Porter & Co., Pittsburgh vii
Pottsville Spike Works, Pottsville, Pa. ii
Tudor Iron Works, St. Louis & Chicago —
Springs:
Columbia Car Spring Co., 322 Seventh ave., N. Y. ii
Colmer Spring Co., Pittsburgh ii
A. French & Co., Pittsburgh ii
Steel and Steel Tires:
Isaac Jenks & Sons, 134 Duane st., N. Y. —
Midvale Steel Works, Nicetown, Philadelphia xiv
Thomas Prosser & Son, 15 Gold st., N. Y. x
Randall & Jones, Boston v
Standard Steel Works, Philadelphia x
Switches:
Pennsylvania Steel Co., Harrisburg vii
Wharton R. R. Switch Co., Philadelphia v
Taps and Dies:
H. S. Manning & Co., 113 Liberty st., N. Y. x
Ticket Punches:
L. O. Crocker, Weymouth, Mass vii
Track Tools:
Metcalf, Paul & Co., Pittsburgh v
Turn Tables for Railways:
Wm. Sellers & Co., Phila. & 79 Liberty st., N. Y. xiv
Valves:
Ludlow Valve Manufacturing Co., Troy, N. Y. ix
Peet Valve Co., Boston ix
Varnishes:
Berry Bros., Detroit —
Murphy, Sherwin & Co., Cleveland vi
Valentine & Co., 323 Pearl st., N. Y. xiv
Watches:
Giles, Bros. & Co. vi
Watchman's Time Detectors:
J. E. Buerk, Boston vii
Welding Compound:
Schierich Manufacturing Co. Jersey City ix
Wire Rope:
J. A. Roebling's Sons, Trenton N. J. vi
Wrenches:
A. G. Coes & Co., Worcester, Mass. x
L. Coes & Co., Worcester, Mass. ix
Wanted and For Sale ix

CULMER SPRING CO.

MANUFACTURERS OF



RAILWAY CAR SPRINGS,

Spiral Buffer, Freight Bolster, Journal and Equalizing Bar Springs.

SPIRAL SPRINGS, OF ALL DESCRIPTIONS, A SPECIALTY.

OFFICE & WORKS, Cor. 26th and LIBERTY STS.

HENRY A. BREED, General Manager and Treasurer.

PITTSBURGH, PA.

Copyright secured.

PITTSBURGH CAST-STEEL SPRING WORKS.

A. FRENCH & CO.

MANUFACTURERS OF

Extra tempered light elliptic

CAST-STEEL SPRINGS,

FOR RAILROAD CARS & LOCOMOTIVES,

From best Cast Steel.

Office and Works: Cor. Liberty and 31st Streets, Pittsburgh, Pa.

ST. LOUIS BRANCH—M. M. BUCK & CO.
CHICAGO BRANCH—146 E. LAKE ST.

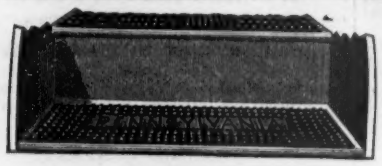
COLUMBIA CAR SPRING CO.,

322 Seventh Ave., cor. 28th St.,

NEW YORK.

BRANCHES:

109 Milk St., Boston,
123 Central Ave., Cincinnati,
17 So. Canal St., Chicago.



Rubber Plates for Car Steps.

Accidents from slipping prevented—icy steps avoided—the elasticity of the rubber breaks the ice when stepped upon.

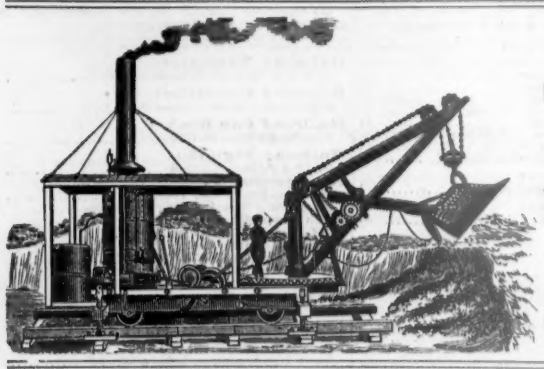
Our step and panel having the name of a railroad moulded thereon is very *ornamental*, and adds much to the appearance of car steps.

MANUFACTURED BY

Rubber Step Manufac'g Co.,

43 Haverhill Street, Boston.

Send for circular.



ALGER'S

Patent Friction

EXCAVATORS

AND

DREDGES,

MANUFACTURED BY

Vulcan Iron Works Co.,

Oswego, N. Y.,

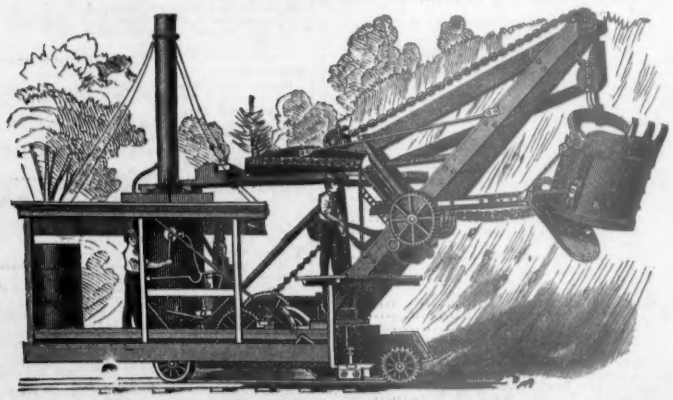
AND

S. B. ALGER,

Long Island City, N. Y.

JOHN SOUTHER & CO., Boston, Mass.,

Exclusive Manufacturers of the



Otis Patent Steam Excavators

WITH CHAPMAN'S IMPROVEMENTS, AND DREDGES.

THOMAS MAY & CO.,

MANUFACTURERS OF THE STANDARD

CAR AND LOCOMOTIVE WHEELS.

Spoke Engine Truck Wheels a Specialty.

Cor. Tenth and Sheldon Sts., INDIANAPOLIS, IND.

THE HAMILTON STEELED-WHEEL CO., OF PHILADELPHIA.

W. G. HAMILTON, President.
WM. M SPACKMAN, Treasurer.
CHAPMAN BIDDLE, Solicitor.

OFFICES.
66 NORTH SECOND STREET
Philadelphia, Pa.

24 BROADWAY
New York.

Grant Licenses to manufacture and use Car Wheels made under Patents of W. G. Hamilton and Geo. Whitney, adding largely to the strength of the metal, and rendering available the use of Non-Chilling irons.

WHEELS AND AXLES MADE OF THE BEST STOCK AND IN THE MOST careful MANNER. FURNISHED SEPARATELY OR "FITTED" MAKING COMPLETE SETS

TAYLOR IRON WORKS ON THE LINE OF THE CENTRAL R. R. OF NEW JERSEY

HIGH BRIDGE, N. J.

CAR WHEELS & AXLES

DRAW HOOKS AND FORGINGS.

LEWIS H. TAYLOR PRES'T.
S. F. RABER SUP'T. JAS. H. WALKER SEC'Y & TREAS.

NEW YORK OFFICE 93 LIBERTY ST.

STEEL TIRED WHEELS MADE UNDER SAX & KEAR'S PATENT FOR LOCO. TRUCK (AND) TENDER PASS'R CAR SERVICE

Southern Agent, WM. J. NICOLLS, 5 Post Office Avenue, Baltimore.

G. G. LOBDELL, Pres't W. W. LOBDELL, Sec'y.
P. N. BRENNAN, Treas.

Lobdell Car-Wheel Co.,

WILMINGTON, DEL.,

Manufacturers of

LOBDELL'S PATENT COMBINATION (DOUBLE PLATE), IMPROVED SINGLE PLATE and IMPROVED HOLLOW SPOKE WHEELS,

Furnished with or without Axles: adapted for Broad and Narrow Gauge and Street Roads.

MAKES OF IRON AND BRASS CASTINGS, ETC.

Also Manufacturers of *CHILLED ROLLS*, for Paper Brass, Copper and Rolling Mills.

HAMILTON RUBBER CO., Trenton, N. J.,

MANUFACTURERS OF

RUBBER GOODS,

FOR MECHANICAL PURPOSES.

CAR SPRINGS A SPECIALTY.

Send for Price List and Discounts.

POTTSVILLE NUT, BOLT AND SPIKE WORKS,

GEO. D. ROSEBERRY,

MANUFACTURER OF

Railroad and MINING SPIKES

Machine Bolts,

Bolt Ends, Wood Screws,

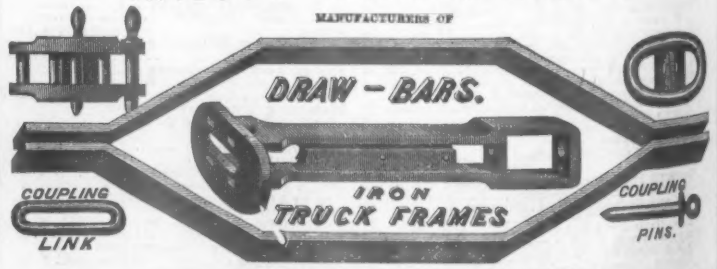
COLD-PRESSED NUTS, &c.,

POTTSVILLE, PA.

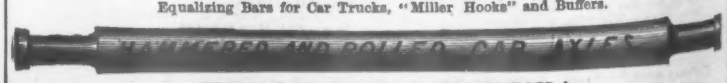
UNION FORGE AND IRON MILLS,

(WILSON WALKER & CO.)

MANUFACTURERS OF



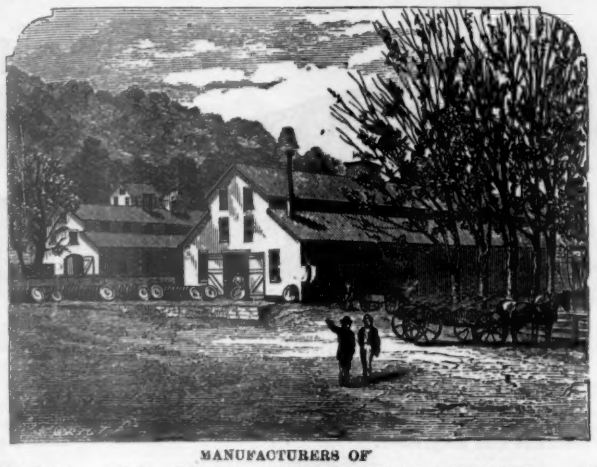
Equalizing Bars for Car Trucks, "Miller Hooks" and Buffers.



UNIVERSAL PLATES FOR GIRDERS, BRIDGES, &c.

Works, corner Twenty-ninth and Railroad Streets, Pittsburgh, Pa.

BARNUM RICHARDSON CO., SALISBURY, CONN.,



MANUFACTURERS OF

CHARCOAL PIG IRON FROM SALISBURY ORES,

AND CHILLED CAR WHEELS.

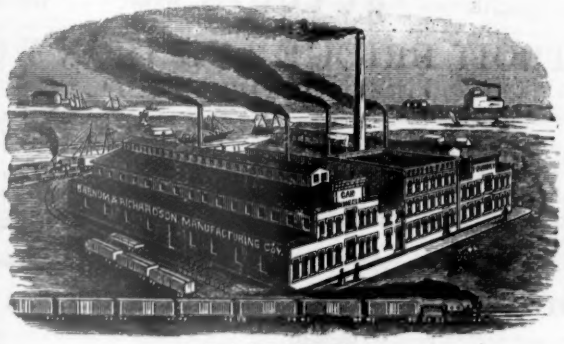
All Work from this Establishment made from Salisbury Iron AND WARRANTED.

ADDRESS
WM. H. BARNUM, Pres't.
LIME ROCK, CONN.

OR,
ALBERT ALLING, Agent for Sale of Pig Iron,
64 SOUTH JEFFERSON ST., CHICAGO, ILL.

BARNUM & RICHARDSON MANUFACTURING CO.,

64 South Jefferson Street, Chicago, Ill.



MANUFACTURERS OF

Chilled Car and Locomotive Wheels, from Pure Salisbury Iron,

ALSO MANUFACTURERS OF

CAR AND ALL OTHER DESCRIPTIONS OF CASTINGS.

All Work Warranted.

WM. H. BARNUM, President, Lime Rock, Conn. | ALBERT ALLING, Gen'l Manager, Chicago, Ill.

ENSIGN MANUFACTURING COMPANY

Huntington, W. Va.,

MANUFACTURERS OF

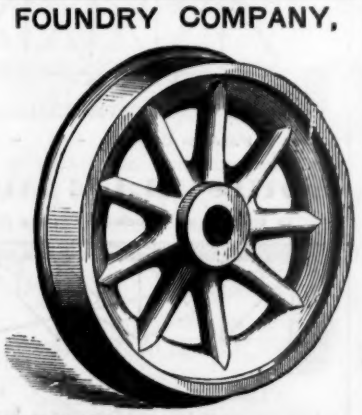
WHEELS,

For Passenger, Freight and Coal Cars, and Locomotive Trucks and Tenders. Also all kinds of Car and Bridge Castings.

W. H. BARNUM, Pres., Salisbury, Conn.

E. ENSIGN, Treas., Huntington, West Va.

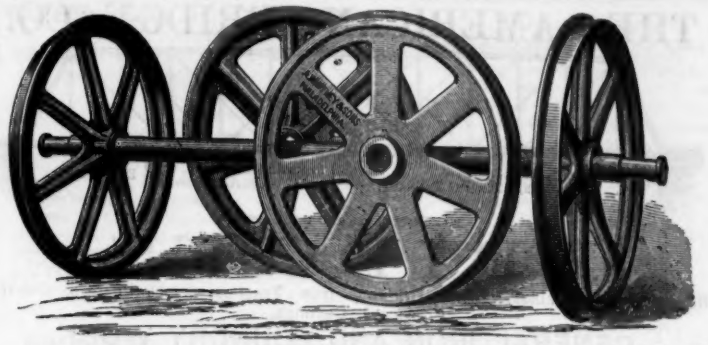
RAMAPO WHEEL AND FOUNDRY COMPANY,



MANUFACTURERS OF

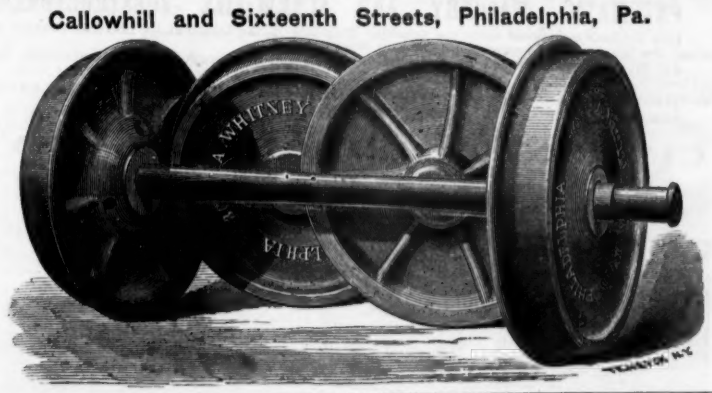
Wheels for Drawing Room and Sleeping Coaches, Locomotives, TENDERS, PASSENGER AND FREIGHT CARS

W. W. SNOW, Sup't & General Manager, Ramapo, Rockland Co., N. Y.



A. WHITNEY & SONS, CAR WHEEL WORKS,

Callowhill and Sixteenth Streets, Philadelphia, Pa.



BALTIMORE CAR WHEEL COMPANY,

OFFICE 15 SOUTH STREET,

Manufacture Wheels for City and Steam Railways,

With or without Axles.

WHEELS OF ALL PATTERNS

Made to Order and in Stock

This Company using strictly Baltimore Charcoal Iron, (which has no superior and few equals, for making Car Wheels,) and annealing their Wheels by the most approved process, warrant them free from strain, and equal in tenacity and uniformity of chill to any made.

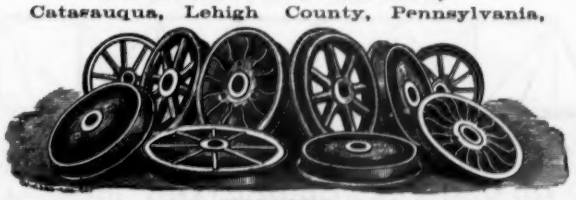
W. S. G. BAKER, President.
J. M. LAWFORD, Secretary.

Works, corner Essex and Concord Streets. Canton, Baltimore. Md.

LEHIGH CAR-WHEEL WORKS,

McKEE & FULLER,

Catasauqua, Lehigh County, Pennsylvania,



MANUFACTURERS OF

Wheels for Locomotives, Tenders, Passenger, Freight, Coal, City Passenger and Mine Cars

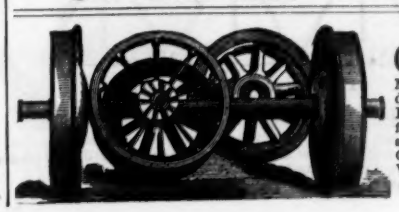
Wheels Fitted to Axles, and Prices Furnished on Application.

CAPACITY, 300 WHEELS PER DAY.

Makes All Kinds of FREIGHT CARS, and the BEST of CAR WHEELS.

J. L. GILL.

Columbus, Ohio.



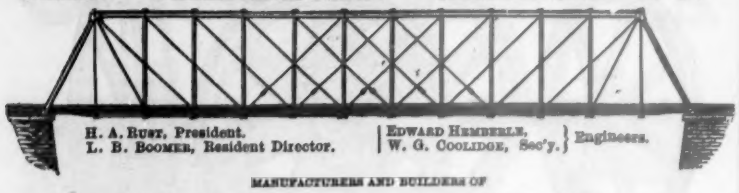
MOWRY CAR AND WHEEL WORKS,

Manufacturers of Cars and CAR WHEELS of all descriptions. Wheels and Axles, Chilled Tires; Engine, Car and Bridge Castings, of any pattern, furnished to order at short notice. Wheels of all sizes constantly on hand.

OFFICE: No. 29 WEST THIRD STREET, Cincinnati.
WORKS: Eastern Av. & Lewis St., Cincinnati, O.

N. G. GREEN, Sup't, Cincinnati.

THE AMERICAN BRIDGE CO.



H. A. RUST, President.
L. B. BOOMER, Resident Director.
EDWARD HEMBERLE, W. G. COOLIDGE, Sec'y. } Engineers.

MANUFACTURERS AND BUILDERS OF

BRIDGES,

Roofs, Turning-Tables, Pivot Bridges, Iron Trestles Wrought Iron Columns Heavy Castings,

GENERAL IRON AND FOUNDRY WORK.

BUILDERS OF

PNEUMATIC MASONRY, AND SCREW-PILE SUBSTRUCTURES.

Iron Bridges and Roofs upon the principal Railroads in the United States illustrate designs and attest the character and extent of products of Works.

☞ Proposals accompanied by Plans, Specifications and Lithographs promptly submitted upon application.

WORKS: Cor. Egan and Stewart Aves. | OFFICE: No. 210 LaSalle st., Cor. Adams.

Address THE AMERICAN BRIDGE CO., Chicago.

CINCINNATI BRIDGE COMPANY.

365 FT. SPAN BRIDGE OVER THE GREAT MIAMI RIVER, FRANKLIN, OHIO.

Manufacturers and Builders of Whipple's Iron Truss and Arch Bridges, FOR RAILWAYS AND HIGHWAYS;

Also ROEBLING'S CELEBRATED STEEL WIRE SUSPENSION BRIDGES.

All kinds of Bridge irons made to order. Only best quality of material used. Send notice of Bridge lettings.

J. W. SHIPMAN, Pres. and Eng.
H. A. MANNING, Sec. and Treas.

Address CINCINNATI BRIDGE CO., 31½ West 3d St., Cincinnati, O.

J. D. HUTCHINSON, Vice-President and Eastern Manager, Peekskill, N. Y.

NIAGARA BRIDGE WORKS

BUFFALO, N. Y.,

BUILDERS OF IRON LATTICE BRIDGES

FOR RAILROADS AND HIGHWAYS.

PLATE GIRDERS, COMPOSITE BEAMS, ROOFS, PLATE TURNTABLES, &c

S. J. FIELDS, ENGINEER. GEO. C. BELL, MANAGER.

Office and Works: Forest avenue, cor. Niagara street.

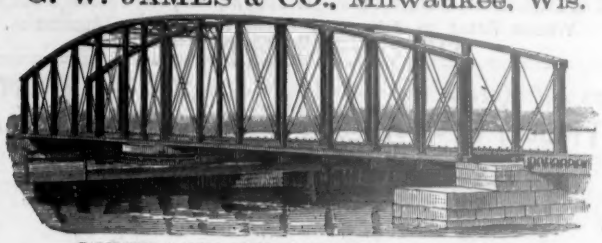
KELLOGG & MAURICE,

OFFICE AND WORKS: ATHENS PA.

Iron and Wooden Bridges, Roofs, Turn-tables, Etc.

THE MILWAUKEE BRIDGE AND IRON WORKS

G. W. JAMES & CO., Milwaukee, Wis.



BALTIMORE & OHIO RAILROAD BRIDGE, SOUTH CHICAGO, ILL.

BALTIMORE BRIDGE CO.,

54 Lexington Street, Baltimore.

C. SHALER SMITH, Prest. & Ch. Eng. F. H. SMITH, A. Eng. & Gen. Supt.

C. H. LATROBE, A. Eng., Sec. & Treas. C. C. WRENSHALL, Supt. of Erection.

Design and Construct Iron, Stee and Composite Bridges and Roofs of any form or span desired. Special attention is called to our Wrought-Iron Trestles and Viaducts, patented in United States, England, France and Belgium, and built of any height or length. Photographs and information promptly furnished.

THE DELAWARE BRIDGE COMP'Y

Office
52 WALL STREET
NEW YORK.

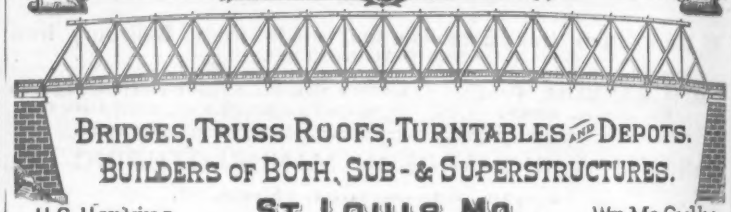
ENGINEERS AND CONTRACTORS FOR THE CONSTRUCTION OF IRON AND WOODEN BRIDGES, STEEL SUSPENSION BRIDGES, ROOFS, VIADUCTS AND TURN TABLES.

Manufacturers of Die Forged Eyebars, Truss Bolts, Compression Members and Bridge materials generally.

C. MACDONALD, President and Engineer. | WM. M. FINCKE, Secretary and Treas.

H.S. Hopkins & Co.

BRIDGE BUILDERS & CONTRACTORS



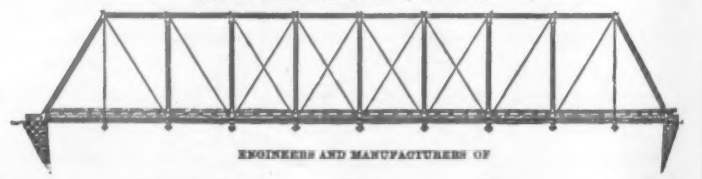
BRIDGES, TRUSS ROOFS, TURNTABLES AND DEPOTS.

BUILDERS OF BOTH, SUB- & SUPERSTRUCTURES.

H.S. Hopkins ST. LOUIS, MO. Wm. McCully

DETROIT BRIDGE AND IRON WORKS,

OF DETROIT, MICH.,



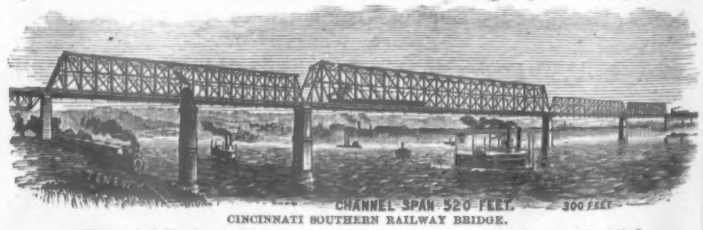
ENGINEERS AND MANUFACTURERS OF

Iron Bridges. Iron Roofs, Etc.

WILLARD S. POPE, Prest. and Engineer. WM. C. COLBURN, Sec. and Treas.

THE KEYSTONE BRIDGE COMP'Y,

PITTSBURGH, PA., Builders of Long-Span Bridges.



CHANNEL SPAN 520 FEET. 300 FEET

CINCINNATI SOUTHERN RAILWAY BRIDGE.

Newport & Cincinnati, 420 ft. *Steubenville, 320 ft.*
Parkersburg, 350 ft. *Cincinnati Southern Ry., 520 ft.* *Bellair, 360 ft.*

Engineers and Builders of WROUGHT-IRON and WOODEN BRIDGES, IRON ROOFS and BUILDINGS. Manufacturers of Wrought-Iron Turntables, Wrought-Iron Columns, Weldless Chords, Castings, Rolls, General Machine and Mill Work. Illustrated Album sent on application to undersigned.

J. H. LINVILLE, President,
318 South Fourth St., Philadelphia.

KING IRON BRIDGE & MANUFACTURING CO.,

CLEVELAND, OHIO.

WROUGHT IRON BRIDGES

Paid in Capital - - - - $225,000 00

LOUISVILLE BRIDGE & IRON CO.,

Office and Works: Corner Oldham and 11th Streets, Louisville.

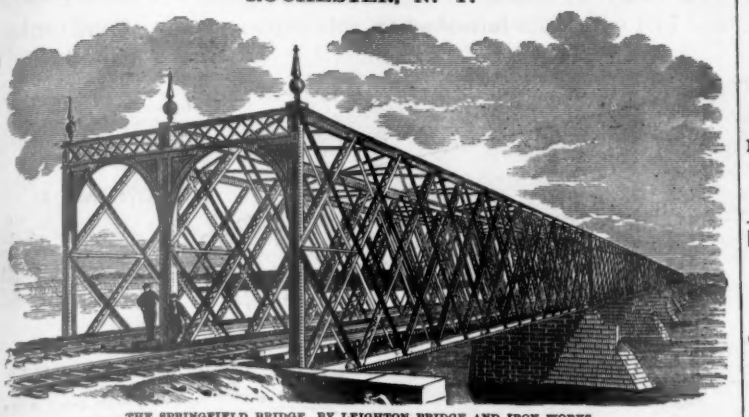
BUILDERS OF

FINK'S SUSPENSION AND TRIANGULAR TRUSSES,

and other forms of Iron and Combination Bridges. Also Manufacturers of Iron Roofs, Turn-tables Frogs, Switches, etc.

ALBERT FINK, President.
A. P. CHROCAN, Secretary.
F. W. VAUGHAN, GILMAN TRAFTON, } Engineers.
E. BENJAMIN, Superintendent of Works.

LEIGHTON BRIDGE AND IRON WORKS,
ROCHESTER, N. Y.

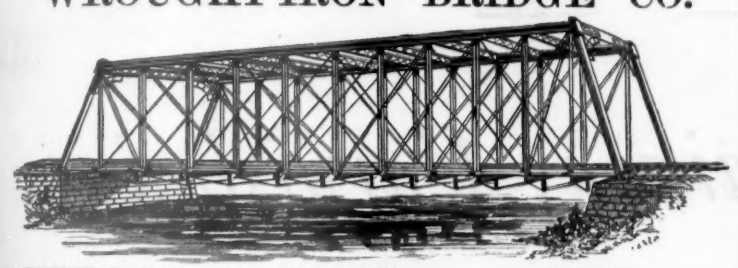


THE SPRINGFIELD BRIDGE, BY LEIGHTON BRIDGE AND IRON WORKS.

Wrought-Iron Riveted Lattice Railroad and Highway Bridges, Wrought-Iron Water Pipe and General Riveted Work.

ORDERS SOLICITED FROM CIVIL ENGINEERS AND CONTRACTORS.

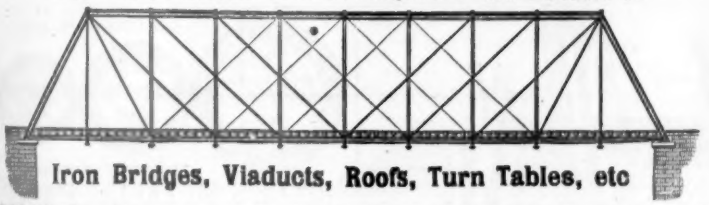
WROUGHT-IRON BRIDGE CO.



D. HAMMOND, President. | WM. BRITTON, Secretary. | **Office and Works, CANTON, O.** | JOB ABBOTT, | H. G. MORSE, | Engineers.

Manufacturers and Builders of all Wrought-Iron Railway and Highway Truss, Arch and Swing Bridges, Plate and Lattice Girders, Iron Roofs, Turn-Tables, Iron Piers and Trestles. Have over TWENTY-FOUR MILES of their IRON BRIDGES now in use in twenty-four different States and Canada. ILLUSTRATED ALBUM and estimates sent on application.

PHŒNIXVILLE BRIDGE WORKS.
CLARKE, REEVES & CO., Engineers and Builders of



Iron Bridges, Viaducts, Roofs, Turn Tables, etc

SPECIALTIES:—Accurate workmanship: the use of double-refined iron; no welds; Phœnix upper chords and posts, the best form of strut known; all work done on the premises, from ore to finished bridge.

ILLUSTRATED ALBUM mailed on receipt of 75 cts. at 410 WALNUT STREET, PHILADELPHIA, PA.

J. H. COFRODE. F. H. SAYLOR

J. H. COFRODE & CO.,
Engineers and Bridge Builders.

DESIGN AND CONSTRUCT IRON, WOODEN AND COMBINATION BRIDGE AND ROOF TRUSSES, &c.,

OFFICE:

No. 530 Walnut Street, Philadelphia.

Edge Moor Iron Co.,

{Works at Edge Moor, on Delaware River, / Post Office, Wilmington, Delaware,}

MANUFACTURE ALL KINDS OF

IRON WORK

FOR

BRIDGES, ROOF TRUSSES AND BUILDINGS.

SPECIALTIES:

HYDRAULIC FORGED EYE BARS.

HYDRAULIC FORGINGS and HYDRAULIC RIVETED WORK.

Specifications from Railroad Companies, Engineers and Contractors solicited, upon which estimates will be promptly furnished.

WILLIAM SELLERS, President. | ELI GARRETT, Sec'y & Treas'r. | GEORGE H. SELLERS, Gen'l Sup't.

ELIZABETHPORT STEAM CORDAGE COMPANY,

MANUFACTURERS OF

Manilla, Sisal and Tarred Cordage,

46 SOUTH STREET,

H. M. FULTON, D. S. WHITLOCK, A. W. LUKENS. } NEW YORK.

SAFETY RAILROAD SWITCH
WITH
MAIN TRACK UNBROKEN,
RAILROAD CROSSINGS, FROGS,
AND OTHER
ROADWAY SUPPLIES,
Manufactured by
THE WHARTON RAILROAD SWITCH COMPANY,
Office, 28 South 3d street.
Works, 23d and Washington avenue,
Philadelphia.

LOWTHORP & HENDERSON,
ENGINEERS AND BUILDERS
OF
BRIDGES AND TURN TABLES
OF WROUGHT IRON, OR COMBINATION OF WROUGHT AND CAST.
78 East State street, Trenton, N. J.
F. C. LOWTHORP, C. E. J. J. HENDERSON,

FOR SALE,
Or to Lease for a Term of Years:

The Car Works of the Buffalo Car Company. The works are new, having a capacity of 12 cars per day; Buildings of brick, slate roofs, heated by steam, with fire hydrants with hose complete. The Machinery is all new and of the best Philadelphia make. Twelve acres of land, and railroad connections with both broad and ordinary gauge roads. The Works can be started without a dollar's expense.

N. C. SCOVILLE, TRUSTEE.
BUFFALO, N. Y.

"TAYLOR'S"
HAMMERED CRUCIBLE CAST STEEL
LOCOMOTIVE TIRES,
AND
BEST YORKSHIRE BAR IRON
RANDALL & JONES,
Oliver street, Boston.

PENCOYD IRON WORKS.
A. & P. ROBERTS & CO.,
MANUFACTURERS OF
CAR AXLES
BAR, ANGLE, TEE AND
CHANNEL IRON.
Office, No. 265 South Fourth St., Philadelphia.

S. SHELDON, Sec'y & Treas. | H. M. CLAFLEN, Prest. | M. W. BRAND, Gen. Manager.

THE LOOMIS NUT LOCK WASHER CO.,
CLEVELAND, OHIO.

Sole Manufacturers of the celebrated LOOMIS NUTLOCK WASHER, for Railroad Tracks, Cars, etc. It is a PERFECT NUT HOLDER. It is made to fit any sized bolt or fish-plate (*requiring but one nut*), and is of the best cast or spring steel, with a perfect spring; therefore WARRANTED not to break or set. It entirely compensates the expansion and contraction of the iron, and the nut will, in NO CASE, turn off of its own accord, however great the jar or strain. ORDERS SOLICITED AND PROMPTLY FILLED.

METCALF, PAUL & CO.,

VERONA TOOL WORKS. TRADE MARK. PITTSBURGH, PA.

Make a Specialty of

SOLID STEEL

RAILROAD TRACK TOOLS

Also Sole Manufacturers of:

THE PATENT

VERONA NUT LOCK.

331 Penn Ave. **Send for our New Catalogue.**

W. H. WAKEFIELD, Chairman. | WESLEY WILSON, Treasurer. | R. LONG, Secretary.

THE AMERICAN RAILWAY SUPPLY CO.
(Limited).

Patented Nov 23, 1875.

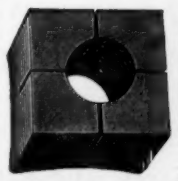
Manufacturers of the Samson Railway Joint, and Dealers in and Agents for Railway Supplies Generally.

P. O. LOCK BOX 1,177. | OFFICE, No. 376 [illegible] Ave., Pittsburgh, Pa.

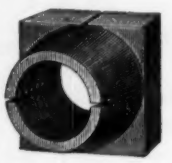
CHAS. I. WICKERSHAM, General Eastern Agent, Office, 265 South Fourth St., Philadelphia,

Patented Nov. 9, 1875.

ATWOOD CONICAL LOCK NUT.



This nut is represented in the engraving on the right, and is made of a conical form on the under side, and fits into the bolt hole which is made of the same shape. The cone and square portions are slotted so that when screwed up into the conical hole, the nut is compressed and clasps the bolt tightly, so that it cannot be shaken loose. The effect of wear is to make it fit the hole more accurately, so that when it is again tightened up it will be less liable to become loose than before it was worn. The conical nut is intended especially for fish plates and bolts.



The engraving on the left represents a square nut cut apart on the top side only. The under side is made concave, so that in screwing it up the hole on the upper side is contracted and clasps the bolt in the same way as the conical nut. The square nut is intended for car work bridges and similar purposes.

The conical nuts are now extensively used in the track of the Philadelphia, Wilmington & Baltimore and Boston & Albany, and have been applied on a number of other railroads. It is simple in construction, being in one piece, has a longer bearing on the bolts than other nuts, and cannot strip the threads, and will always fit the bolts, no matter how loosely the thread is cut.

THE ATWOOD CONICAL LOCK NUT AND MANUFACTURING CO.,
No. 40 Broadway, Room 41, P. O. Box 1,049, New York.

PATENT METALLIC SHEDS AND WAREHOUSES.

These Sheds are

LIGHT, STRONG,

AND

ELASTIC,

therefore especially well adapted to

RESIST VIBRATIONS

From Machinery

and the pressure of heavy winds.

They can be taken asart and put up again in a very short time by any intelligent laborer, and also take little room for shipping by cars or steamers; they are consequently

PORTABLE

in the fullest sense of the word. Being built entirely of

Price List with Cuts furnished on application.

Non - Combustible Material.

they can not be ignited by sparks from locomotives, steamers, or neighboring fires, and in view of this fact they are very

ECONOMICAL,

as the small excess of the cost over a wooden structure is fully compensated by the

REDUCTION

IN THE

INSURANCE RATES

and the greater safety of the property stored.

Manufactured by

SCHWEIZER & GRUWE, 71 BROADWAY, N. Y.

For Uniformity, Durability and Economy, use

"The Murphy Railway Varnishes"

MURPHY & COMPANY,
Newark, N. J.

MURPHY, SHERWIN & CO.
Cleveland, O.

Elliot's Patent
STEEL
Rail Frogs
AND
Crossings.

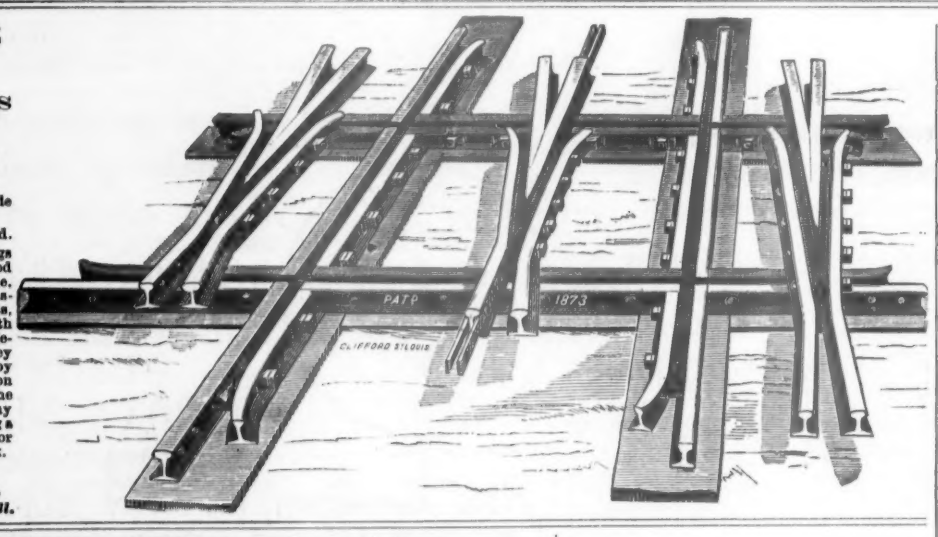
Frogs and Crossings made any angle desired.

Rail from 30 to 62 lbs. per yd.

These Frogs and Crossings are made of steel, combined with a wrought-iron frame, and bound together transversely with strong bolts, which gives it great strength and durability without destroying its elasticity. They are connected at all ends by Fish Plate Joints, and lie on the same tie surface as the running rails without any cutting of ties, thus saving a great deal of time and labor in putting in place in track.

Manufactured by

H. & H. ELLIOTT,
East St. Louis, Ill.



ESTABLISHED 1858.

TRADE MARK, PATENTED.

PRINCE'S METALLIC PAINT,
AN INDESTRUCTIBLE COATING FOR
IRON, TIN, OR WOOD,
For Sale by the Trade and
PRINCE'S METALLIC PAINT CO.,
Manufacturers,
225 Pearl Street, New York.

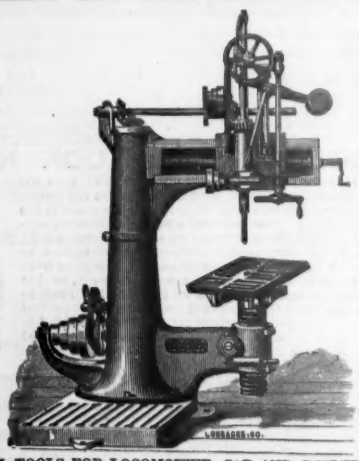
Caution.—As certain parties are offering for sale a SPURIOUS PAINT, under an imitation name, purchasers will please see that our TRADE MARK is on every package. None other genuine.

WIRE ROPE

JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty street, New York. Wheels and Rope for conveying power long distances. Send for circular.

GILES BRO. & CO.,
266 & 268 Wabash Avenue,
CHICAGO, ILL.
FINE WATCHES A SPECIALTY.
Railroad Time-Keepers, One-Fourth Seconds, Sporting Watches, Repeaters, &c.
AGENTS FOR JURGENSEN, HOWARD & ELGIN WATCHES.

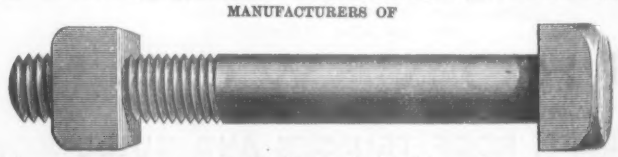
WILLIAM B. BEMENT & SON,
MANUFACTURERS
OF
Engine-Lathes,
Axle-Lathes,
Wheel-Lathes,
WHEEL-BORERS,
WHEEL-PRESSES,
PLANERS,
SLOTTING MACHINES,
SHAPING MACHINES,
BORING AND TURNING MACHINES,
STEAM-HAMMERS,
SHAFTING, HANGERS,
&c., &c.



RAILROAD
MACHINE TOOLS,
Radial, Horizontal and Upright Drills,
MILLING-MACHINES,
CENTERING-MACHINES,
Axle Cutting-Off Machines,
BOLT-CUTTERS AND NUT-TAPPERS,
Punching and Shearing Machines,
Riveting Machines,
BENDING ROLLS.

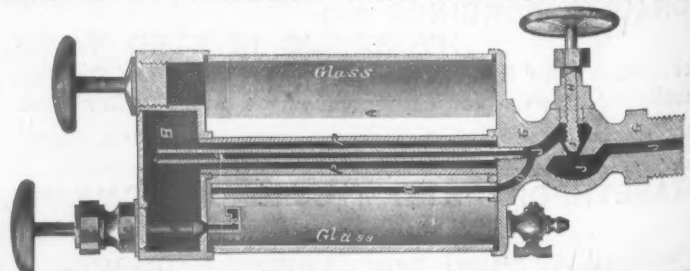
SPECIAL TOOLS FOR LOCOMOTIVE, CAR AND BOILER WORK.
Office and Works, Corner Callowhill and Twenty-first streets Philadelphia.

HOTCHKISS & GAYLORD.
MANUFACTURERS OF



Machine Bridge and Railroad Bolts, Coach Screws, Bolt Ends, Track Bolts, &c.
CLEVELAND, OHIO.

Parshall's CONTINUOUS FEEDING LUBRICATORS.

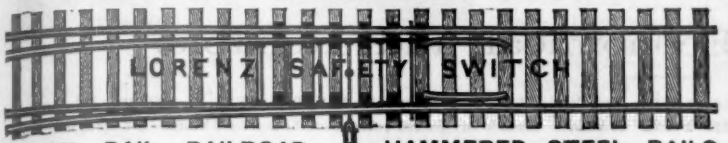


These Lubricators are especially adapted to lubricating Locomotives through the STEAM PIPE, and lubrication is directly under the control of the engineer. Lubrication always regular and constant. For particulars address

C. H. PARSHALL,
135 Alfred Street, DETROIT, Mich.

PENNSYLVANIA STEEL COMPANY,

MANUFACTURERS OF THE



STEEL-RAIL RAILROAD FROGS AND CROSSINGS,

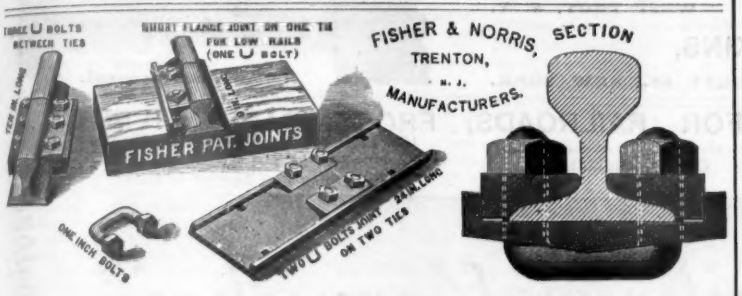
HAMMERED STEEL RAILS AND STEEL FORGINGS.

SAMUEL M. FELTON, President.

EBEN F. BARKER, Secretary. HENRY C. SPACKMAN, Treasurer.
L. S. BENT, Superintendent.

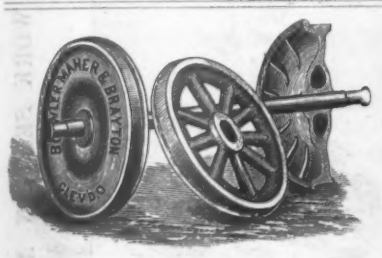
OFFICE: 216 South Fourth Street, Philadelphia.

WORKS: Baldwin Station (Near Harrisburg), Pa.


THREE U BOLTS BETWEEN TIES
SHORT FLANGE JOINT ON ONE TIE FOR LOW RAILS (ONE U BOLT)
FISHER PAT. JOINTS
ONE INCH BOLTS
TWO U BOLTS JOINT RAILLONG ON TWO TIES
FISHER & NORRIS, TRENTON, N. J. MANUFACTURERS. SECTION

The rail flanges being bolted *vertically* between heavy horizontal plates, the load is taken directly by the bolts, and the rails are supported on their *bases*, instead of being hung "by the ears" on the narrow edges of fish bars. As there are no cross strains on these vertical bolts, no "washers" or rubber inventions are required to keep the nuts tight. The FISHER system of fastening admits the use of any form to the head of the rail, and, by smoothness of track, preservation from battering of ends of rails, and little care required, gives the most durable and economical joint yet devised. They have been in extensive use on many important roads for from four to thirteen years past. Further information will be furnished by the manufacturers. FISHER & NORRIS, Trenton, N. J.

C. A. HOTCHKISS. PHILIP GAYLORD.



CLEVELAND FOUNDRY

Car Wheels of all kinds and sizes,

With or Without Axles.

CHILLED FACED RAILROAD FROGS.

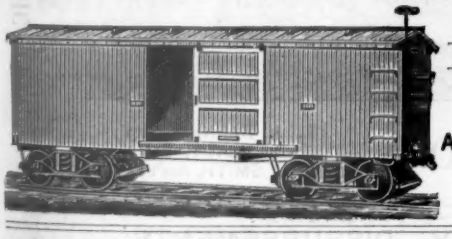
Street Railroad Turnouts.

Rolling Mill and Machinery Castings.

Nos. 9, 11 & 13 Winter Street,

BOWLER, MAHER & BRAYTON.

TERRE HAUTE CAR & MANUFACTURING CO.,



MANUFACTURERS OF

FREIGHT CARS

AND CAR WHEELS OF ALL DESCRIPTIONS.

TERRE HAUTE, IND.

BOSTON, U. S. A.

Travelers desiring the Best Hotel Accommodations in a choice locality, near the Public Garden, Common, Public Library, Museum of Fine Arts, Churches, the Railroad Stations, and Places of Amusement.

THE BRUNSWICK,

Boylston Street, corner of Clarendon, Boston, offers Superior Attractions.

The structure is new and FIRE-PROOF, and is supplied with a Passenger Elevator. It is furnished most elegantly, and is supplied with every modern convenience, having hot and cold water in every chamber and bath-rooms in every suite. The Heating and Ventilating Apparatus throughout the whole house is on the most approved plan. Parties desiring information will receive prompt attention by addressing by letter or by direct application to

J. W. WOLCOTT, Proprietor.

BRADLEY'S CUSHIONED HELVE HAMMERS

Has won golden opinions from the Mechanical World, during the four years it has been before the public, and has reached a sale of 190 Hammers, all in successful operation, in this and foreign countries.

It Has More Good Points,
Less Complication,
More Adaptability,
Does More and Better Work, Larger Capacity,
Takes Less Power,
Costs Less for Repairs
than any Hammer in the World.

GUARANTEED AS REPRESENTED.

Western Office, 22 South Canal St., CHICAGO, ILL.
A. B. BARNES, Manager.

[Established 1832.]

BRADLEY MANUFACTURING CO., SYRACUSE, N. Y.

DILWORTH, PORTER & CO.,

RAILROAD

SPIKES AND FASTENINGS,

PITTSBURGH.

HOISTING ENGINES.

ALL STYLES. BUILT BY

COPELAND & BACON,

NEW YORK.

BUERK'S Watchman's Time DETECTOR.

Important for all Large Corporations and Manufacturing Concerns.

Capable of controlling with the utmost accuracy the motion of a watchman or patrolman as the same reaches different stations of his beat. The instrument is complete in itself, portable and as reliable as the best lever watch. It requires no fixture or wires communicating from room to room, as is the case with the ordinary watch clocks. A small, inexpensive stationary key is alone required at each station. The instrument will, in all cases, be warranted perfect and satisfactory.

N. B.—The suit against Imhaeuser & Co., of New York, was decided in my favor, June 10, 1874. Another suit has been decided against them and a fine assessed Nov. 11, 1876, for selling contrary to the order of the Court. Persons using clocks infringing on my Patent, will be dealt with according to law.

J. E. BUERK, Proprietor,

P. O. Box 979. No. 230 Washington Street, Boston.

☞ In sending for circular or ordering the above, please mention this paper. ☜

HOOPES & TOWNSEND,

MANUFACTURE

machine and Car Bolts, Wood Screws, Cold-Punched square and Hexagon Nuts, Washers, Keystone Boiler Rivets, Tank Rivets, Railroad Track Bolts, Chain Links, Car Irons, Bridge Bolts, Bridge Irons Rods and Bolts for Buildings, &c.,

No. 1330 Buttonwood st., Phila.

GEO. J. BURKHARDT & CO,

Cedar Tank Factory,

No. 1,341 Buttonwood St., Philadelphia.

Tanks and Reservoirs from 150 to 150,000 gallons, for Railroads, Rolling Mills, Factories, Private and Public Buildings.

DEAD-STROKE POWER HAMMERS.

Improved Hydraulic Jacks,

Manufactured by

PHILIP S. JUSTICE,

PHILADELPHIA, PA.

RICHARD DUDGEON.

24 COLUMBIA ST., NEW YORK,

MAKER AND PATENTEE OF IMPROVED

HYDRAULIC JACKS.

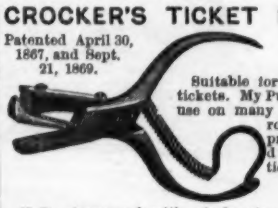
Punches, Roller-Tube Expanders, & Direct-Acting STEAM HAMMERS.

Communications by letter will receive prompt attention.

JACKS FOR PRESSING ON CAR-WHEELS OR CRANK PINS MADE TO ORDER.

CROCKER'S TICKET PUNCH.

Patented April 30, 1867, and Sept. 21, 1869.

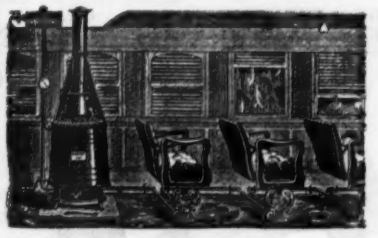


Suitable for any kind of tickets. My Punches are in use on many leading railroads, and have proved to be a durable article.

N. B.—Any punch with spiral springs to throw off tickets is an infringement on my patent. All persons are warned against purchasing them.

L. O. CROCKER,
Lock Box 17, Weymouth Landing, Mass.

BAKER'S PATENT CAR WARMER.



Hot Water Pipes at the Feet of Each Passenger.

Full Descriptive Pamphlets Furnished on Application.

BAKER, SMITH & CO.

Cor. Greene & Houston sts., NEW YORK. | 81 & 83 Jackson st., CHICAGO.

HOPKINS' PATENT LEAD-FACED JOURNAL-BEARINGS.

Self-Fitting, Non-Heating, Economical and Reliable.

Adopted by the N. Y. Central & Hudson River R. R., Boston & Albany R. R., Del. & Hudson Canal Co.'s R. Rds., Old Colony R. R., B. & Prov. R. R., N. Y., Prov. & B. R. R., Erie R'y., Del., Lack. & Western R. R., Lake Shore R. R., and other Roads too numerous to mention, and also adopted for "THE FAST MAIL." Made to any desired pattern, of the best hard bronze, and faced with Lead which enables them to at once fit themselves perfectly to the journal, whether new or old, thus insuring cool running and the consequent realisation of a largely increased average mileage. Hollow worn journals in their first stages, may also be rendered serviceable by the use of these bearings and their recurrence avoided. Being furnished at a cost (freight charges included) not exceeding that of good ordinary brasses, and old brasses being taken in exchange at a fair rate, it will be seen that these bearings are not only the most reliable but also the most economical brasses in use.

Section showing the relative thickness of the Lead Facing.

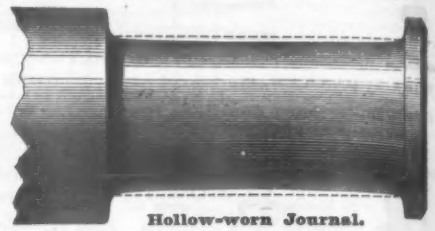
For further information, testimonials, etc., see circular.

Orders and inquiries from the New England States, New York (State) and Dominion of Canada, should be addressed to

GEO. R. MENEELY & CO.,
WEST TROY, N. Y.

From elsewhere to

D. A. HOPKINS,
113 LIBERTY ST., NEW YORK.



Hollow-worn Journal.

MANUFACTURERS OF ROLLING STOCK FOR RAILROADS, FROGS, CAR WHEELS,

Capital Stock, $750,000.
Grounds Occupied, 18 Acres.
Capacity, 15 Freight Cars & 160 Car Wheels per day.

And all Kinds of Castings.

10 Passenger and Baggage per Month.
EMPLOY 1,000 MEN.
Six Million Feet Lumber in Store.

SPECIAL ATTENTION GIVEN TO NARROW GAUGE WORK.

PHOTOGRAPHS OF WORK SENT ON APPLICATION.

E. E. BARNEY, Pres't.
PRESERVED SMITH, Vice-Pres't and Treas.

ESTABLISHED 1849.

BARNEY & SMITH M'F'G CO.,
DAYTON, OHIO.

E. J. BARNEY, Sup
J. D. PLATT, Sec'y,
F. E. SMITH, Ass't Sec'y.

BALDWIN LOCOMOTIVE WORKS.

BURNHAM, PARRY, WILLIAMS & CO., Philadelphia,

LOCOMOTIVE ENGINES.

Especially Adapted to Every Variety of Railroad Service, including
Mining Engines and Locomotives for Narrow-Gauge Railways
All work accurately fitted to gauges, and thoroughly interchangeable. Plan, Materials, Workmanship, Finish and Efficiency fully guaranteed.

GEO. BURNHAM. CHAS. T. PARRY. WM. P. HENSZEY.
EDWARD H. WILLIAMS. EDW. LONGSTRETH. JOHN H. CONVERSE.

JUST PUBLISHED:

"RAILWAY DISBURSEMENTS

AND THE ACCOUNTS INTO WHICH THEY ARE NATURALLY DIVIDED."

BY MARSHALL M. KIRKMAN.

This work is intended to give full and minute instructions for the guidance of those agents and employes of railroad companies who may be entrusted with the disbursing of the money or material of the corporation, in such manner as to insure the strict accounting for everything, leaving no loop-holes for undetected waste or wrongful appropriation of the company's property.

The book consists chiefly of formal rules, illustrated by forms of the blanks recommended and referred to. These rules are the result of many years' experience, most of them having been practically applied and amended from time to time as seemed advisable to make them thoroughly effective and perfectly clear. It is believed that they will be, for the most part at least, found applicable on all American railroads, and can be issued as instructions to employes accordingly.

The most complete and exact rules for keeping railroad accounts ever published.

PRICE $2, POSTAGE PAID.

PUBLISHED BY THE RAILROAD GAZETTE,
73 Broadway, New York.

THE "EUREKA" STATION TICKET

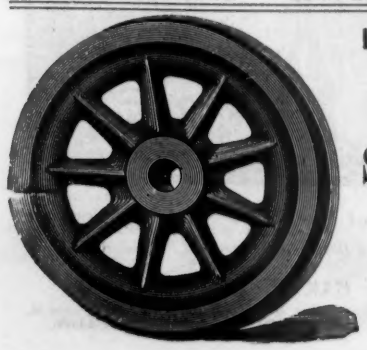
Is a combination of Station, Stop Over and Half Fare Ticket. Only one form required for an entire line which is good at all stations and in all directions; it also does away with Conductors' Private Checks.

Manufactured solely by the Am. Duplex Ticket Co., who also apply their principle to Cash Fare, Excess Baggage, Stop Over, and numerous other forms of

RAILROAD AND STEAMBOAT TICKETS.

These tickets have been in successful operation for the past four years, and are now in use upon more than One Hundred and Twenty-five Roads, including most of the principal lines in this country and Canada. Samples and information furnished with pleasure by

W. H. CAMPBELL, Manager, 860 Broadway, New York.



LOUISVILLE CAR-WHEEL AND RAILWAY SUPPLY COMPANY.

491 East Jefferson St.,
LOUISVILLE,
KENTUCKY.

CAYUTA WHEEL & FOUNDRY CO.,

P. O. Address: WAVERLY, N. Y.,
Works at Sayre, Pa.

MANUFACTURERS OF

WHEELS

FOR

TENDERS,
PASSENGER,
FREIGHT
AND
COAL
CARS;

ALSO

CASTINGS OF EVERY DESCRIPTION

REGINALD CANNING, Supt.

RAILROAD GAZETTE

FRIDAY, MARCH 9, 1877.

The Locomotive "John Bull."

Nearly all railroad men who visited the Centennial Exhibition were interested in the old locomotive represented by our engraving. The following lucid statement of its history, which was exhibited with the engine, is all the description that is needed:

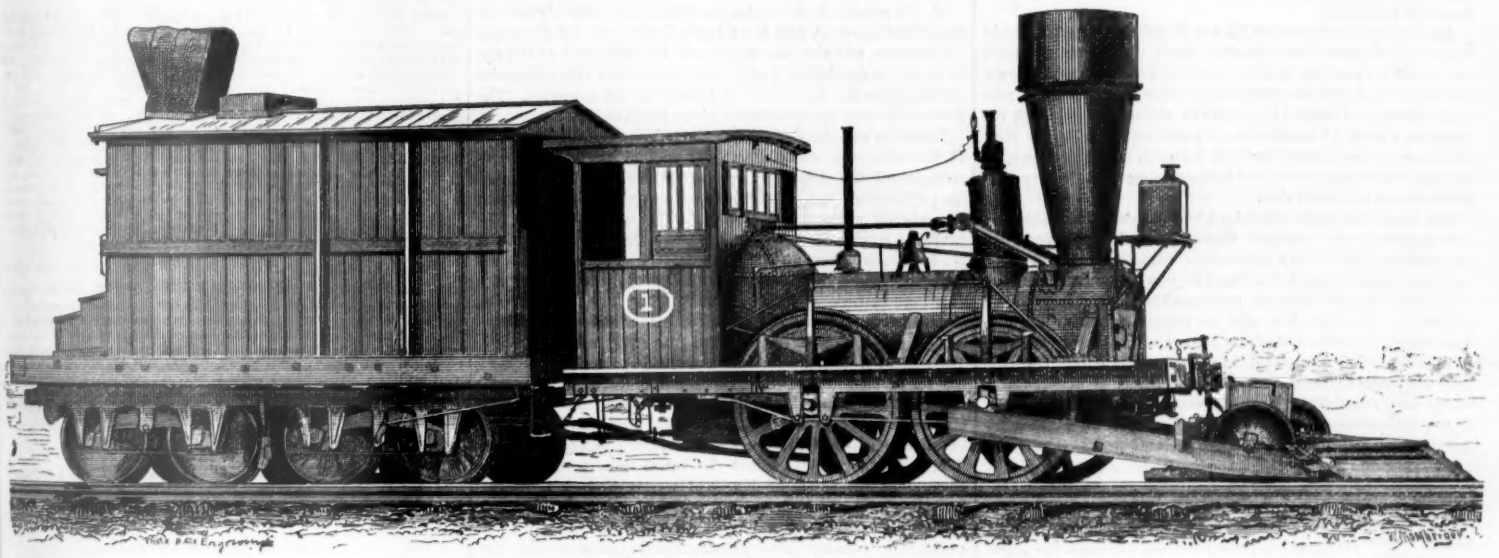
"The locomotive John Bull was built by Messrs. Geo. & Robert Stephenson, at Newcastle-upon-Tyne, England, for the Camden & Amboy Railroad & Transportation Company, in the year 1831.

"It arrived in Philadelphia in August, 1831, and was transferred to Bordentown, New Jersey, on Sept. 4, 1831.

ORIGINAL DIMENSIONS.

"Cylinders, 9 in. diameter × 20 in. stroke. One pair of driving wheels, 4 ft. 6 in. diameter. One pair of wheels, 4 ft. 6in. diameter, not coupled. Hubs of wheels were of cast iron, the spokes and rims of wheels of wood. Tires of wrought iron, the weight about ten tons.

"On arrival at Bordentown it was transferred from the sloop in which it had been brought from Philadelphia by means of wagons to the only piece of permanent track of the Camden & Amboy Railroad Company then completed there, and about three quarters of a mile in length, and about one mile distant from Bordentown. The machinery was there put together, and a tender constructed from a whiskey hogshead placed on a four-wheeled platform car, which had been used by the contractor in the construction of the road. The connection between the pump of the locomotive and the tank was made by means of a leather hose fitted up by a shoemaker in Bordentown. The locomotive was first put in steam September 15, and several trial trips were made before the first public trial on the 12th day of November, 1831—Isaac Dripps* acting as engineer, Benjamin Higgins as fireman and R. L. Stevens as general in-



LOCOMOTIVE "JOHN BULL."

Built for the Camden & Amboy Railroad & Transportation Company, by George & Robert Stephenson, at Newcastle-on-Tyne, England, in 1831.

structor and conductor. The members of the New Jersey Legislature and a number of other prominent persons were among the guests present.

"The John Bull remained at Bordentown until the year 1833, when the Camden & Amboy Railroad Company began running their cars by steam power—the road having been previously operated with horses. It was then placed on the road, doing the regular rountine service, and continued in successful operation until 1866.

TRACK.

"The track upon which this train stands is a portion of the original iron rail* track that was laid on the Camden & Amboy Railroad. The rails were rolled in England, and the stone blocks on which the rails were laid were prepared at great expense, as wooden cross ties were then considered unsafe for such heavy engines."

The blocks exhibited were 2 ft. square and 1 ft. thick, and were some of them granite and others white limestone or marble.

Contributions.

The Justifiable Expenditure for Improvement in the Alignment of Railways.

BY ARTHUR M. WELLINGTON, C. E.

[Continued from page 98.]

(*Copyright*, 1876, *by the Railroad Gazette.*)

THE COST OF EXCEEDING THE LIMITING POINT OF CURVATURE.

We here touch upon an intricate question—one of the most so connected with location. It will be impossible for us to do more than offer a few hints, for any adequate analysis would require a separate paper at least.

It is very obvious that on many railways we *must* use curvature which will limit trains in advance of gradients; and, even when we can manage to avoid it, we are in no case justified in doing so without a careful estimate of the extent of the operating economy effected by so doing.

As a general rule, however, there will be no necessity of introducing curvature so sharp as to have a limiting effect on trains if the ruling grade on tangents be over 40 or 50 feet per mile; provided we adopt such a graduated scale of adjustment between grades and curvature as we have already suggested (Table N); for we may then use very sharp curves, if necessary, by reducing grades to a level. For lower ruling grades on tangents, however, the use of limiting curvature is, as a rule, entirely unavoidable.

In such cases, we are to remember that Table M has been carefully kept within limits where there was *certainly* no limiting effect from curvature. But we are not justified in incurring much expense till we are certain there *is* a limiting effect; and this point of *certainly* would not be until we exceeded by one or two degrees the limits indicated by Table M.

When we are clearly exceeding the limiting point for freight trains, however, we shall not reach the limiting point for passenger trains till we introduce curves sharper by 1° or 2°. For passenger trains are always run at high speed, with ample motive power, and have a relatively low coefficient of curve resistance, which is in no danger of mounting up on them from low speed and insufficient motive power. Consequently any increase of radii which already exceed the limiting point for passenger trains will have value for freight trains only. On the other hand, in respect to the maximum grade on tangents the case is the other way; there is a certain value in reducing them per passenger train considerably in advance of the point where it has value per freight train. The equivalent straight grade to 60 feet + 6° curves is, for freight trains, about 84 feet; and, for passenger trains, not more than 70 feet. Therefore, if a reduction from 84 to 70 feet would pay *for passenger business only* we are justified in making it.

Again, the point of limiting curvature will vary very much with the balance of traffic. If there is much inequality, there will doubtless be many trains of empty cars; but we are not justified in *incurring expense* to adhere to the corresponding standard of curvature, unless it will be paid for by those trains alone. It is to be remembered, also, that in no case can we expect to have trains of fully loaded cars, even with an evenly balanced traffic. The best which is practically accomplished with such traffic is to average about two-thirds of a load. As the inequality of traffic increases, however, the average carload in the direction of heaviest traffic also increases, until, on the great east-and-west trunk lines, which have a heavy inequality of traffic, there are very few cars going east without a full load.

Finally, the most important consideration of all is the probble weight of engine. This *very greatly* affects the allowable maximum curvature; and for this reason, if no other, the weight of engine to be used should be settled, as near as may be, before beginning location. A simple calculation by the formula used in preparing Table M will show that the equivalent curve on a level to a tangent maximum grade of 30 feet per mile is, for a 10-ton engine (on drivers), a 10° curve; for a 20-ton engine, 7°; for a 30-ton engine, 5°; and for a 40-ton engine, only 3½°. This is a very marked and important difference and is the *main* explanation of the advantage in respect to curvature which narrow-gauge railways undoubtedly have, but their advocates do not comprehend or at least admit the cause of it. It is equally open (in fact more so) to any common-gauge railway of light traffic which will have sense enough to use light engines. There is a far more close and intimate connection between the volume of traffic and the advisable weight of engines than is commonly appreciated: it might almost be said to vary directly with the traffic. Engines can hardly be too heavy for a heavy traffic nor too light for a light traffic, and this question should be decided, after careful and thorough investigation, before the final location is attempted. But to follow up the various economic problems connected with location which this question brings up, we should have to begin a new volume at once; and it is to be feared that possibly it is asking too much of locating engineers that they shall bother their head over the probable weight of engines which will not be running for a year or two after they are paid off and gone.

Granting the proper limit of maximum curvature to have been carefully determined for each class of traffic, after considering all the various details suggested above, the writer would estimate the cost of exceeding this limit as about equivalent, per passenger train per degree of curvature, to an increase of two feet per mile in the ruling grade; and per freight train, to an increase of four feet per mile (or possibly in some cases five feet per mile); without now stopping further to explain or to justify this position. These values may be determined from Table E, page 92, for any grade. Thus, if we wish to estimate how much more an inflexible standard of 60 feet + 6° curves was worth to the Cincinnati Southern Railway than an inflexible standard of 60 feet + 8° curves—without now questioning the propriety of either standard—we should find it—allowing interest at 7 per cent. cost of train-mile $1.25, length of division 93 miles, and the equivalent straight grade to the standard adopted 80 feet per mile—to be worth $12,436 per daily passenger train and $24,872 per daily freight train. Allowing the large business of 11 freight + 3 passenger trains, this would give the required difference in value as $310,900; or, for half that business, $155,450, the latter being the more probable volume of business. Thus we see that, in all probability, an unjustifiable expense was incurred even to keep 8° curves off the 60-feet grades; which illustrates how important it is not to guess at a solution of economic problems.

GENERAL AND CONCLUDING REMARKS.

When a railway is projected—if it be a legitimate enterprise and not a mere speculation—a number of economic problems arise which are not within the legitimate sphere of the engineer's duties, but nevertheless must be settled. The history of the inception of a railway is, in its economic aspects, about as follows: A certain number of men conclude that there is sufficient need of a railway to justify the expenditure of a certain *gross amount* in constructing it. This conclusion is not necessarily expressed in a definite sum in advance, but such a conclusion is in effect reached—although often in a very vague form—whenever it is decided to proceed with construction. It does not by any means necessarily follow that the railway is expected to be a source of *direct profit*; for it may be of the highest value to the community and the investors, and yet may never pay a dollar of dividend. In fact, the great majority of the railways of the world have not been directly profitable, yet how vast beyond calculation have been their benefit.

All these questions may properly be considered by the projectors before deciding on construction; and with them the engineer, *as an engineer*, has nothing whatever to do, beyond furnishing a rough estimate of the cheapest line which can be built between the two termini for the given traffic in view, taking into consideration the given rate of interest on capital for construction. The question whether to *build the line at all* or not is one of mere finance and business judgment, and must be settled by an estimate of the probable cost per mile, gross and net receipts, direct profits, and indirect advantages.

Another question which is outside of the strict line of an engineer's duties is the probable difference in way traffic on different lines, although the question as to just how far this difference affects the value of the alternate alignments is a strictly engineering question of the highest importance.

These questions settled, however, the province of the locating engineer begins. We are now done altogether with the question of probable receipts, profits, aggregate cost, and average cost per mile, and the duty of the locating engineer is to neglect them absolutely and consider only OPERATING EXPENSES; endeavoring so to adjust his alignment that the aggregate of those expenses and the interest on cost of construction shall be the smallest possible. To this end it is imperatively necessary that a most careful and detailed investigation should be made into a number of different questions, which at the best are hard to foresee with any degree of exactness. Among these questions are:

1st. *The probable number of trains daily*, in every class of traffic and on different sections of the line.

2d. *The probable weight of traffic in each direction* for each class of trains and on different sections of the line.

3d. *The probable cost per train mile* for each class of traffic.

These three questions should be determined with great care by the examination of the statistics of neighboring and competing railways; and preferably (if it is designed to make use of the tables in this volume) by determining the probable cost

* The form of these rails was described and illustrated in the *Railroad Gazette* of Aug. 21, 1875.

of "line" or "transportation" expenses only, and then estimating the total cost of a train mile as $\frac{100}{40}$ of that amount. Station, terminal and general expenses are the most variable of all the items of operating expense in the first place and are little if any affected by the alignment in the second place.

4th. *The probable receipts per train mile from way traffic* for both passenger and freight trains and on different parts of the line.

5th. *The most advisable weight of engines.* This depends both on the gradients and on the volume of traffic, and has a momentous effect on the cost of construction as well as on operating expenses. The writer has reluctantly neglected to consider it in this volume, although he believes that, with the abundant stores of empyrical knowledge from which we may draw at will, the problem is capable of very exact analysis. Some remarks on this head were made above. The balance should always lean in favor of light engines for light traffic for another reason, viz.: on account of the increase of business which is stimulated by more frequent trains; and by light traffic we mean anything less than 8 or 10 trains daily.

6th. *The greatest length of trains which will be hauled in the daily routine of business.* On this question also we have made some remarks above.

These are the *more important* data, which should *always* be determined separately for every railway, with the greatest care. In addition to those mentioned, a more specialized estimate should be made of the various problems of a more general nature, which we have considered at great length in this volume, to be sure, but, nevertheless, have of necessity determined nothing more than a kind of average.* For example, any important variation in the cost of fuel either way from the average of about 10 per cent. of the operating expenses, will considerably affect the value of the various details of alignment. After such special investigation, however, the intelligent reader will find no difficulty in making the necessary substitutions in the various tables of this volume, without reasoning out the whole process from the beginning.

Another question as to which the locating engineer should have some definite ideas, if only to check the vague visions of his board of directors, is as to the PROBABLE GROWTH OF TRAFFIC IN THE FUTURE, and the justifiable *present* expenditure to provide therefor. It would be absurd to claim that *no* such expenditure should be made, for on many railways in the West for example, the present business is almost *nil*; but as a general rule the excuse of "a rapidly increasing traffic" covereth a multitude of economic sins.

The writer had collected quite a body of statistics bearing on this question, but to analyze them in detail would require a long paper; and his own patience is exhausted, as well as his readers', in the attempt to include in one volume a discussion of all the various problems connected with the economy of alignment. In Table O we give the present justifiable expenditure to save $1 at the end of any given period at any given rate of interest. This fact given, it logically follows that, if we expect our traffic to double in any given time, we may increase our present expenditure by the percentage given in the table. This is undeniably correct *in theory*; in fact, we might enter into further mathematical subtleties, and prove that if the

TABLE O.

SHOWING THE JUSTIFIABLE PRESENT EXPENDITURE TO SAVE $1 AT THE END OF DIFFERENT PERIODS OF TIME.

Rate of interest on capital.	5 years.	10 years.	15 years.	20 years.	25 years.
5 per cent.....	$.783	$.614	$.481	$.377	$.296
6 " "	.748	.558	.417	.312	.232
7 " "	.714	.508	.362	.258	.185
8 " "	.684	.465	.316	.216	.145
10 " "	.621	.385	.240	.147	.092

REMARK.—Other values than those given may be determined as follows: The value of $1, at compound interest for n years at r per cent.

$$= (1 + r)^{-n}$$

Then, 1 ÷ the value thus obtained (given by inspection in a table of reciprocals) gives the sum which will produce $1, if placed at compound interest for the given period of time.

ratio of growth of business is greater than the rate of interest on capital, the present justifiable expenditure, to provide for such increase of traffic, is *infinite*. But all such speculations are wholly delusive, and even the indications of Table O are of value only as fixing a maximum which should never be exceeded. It is to be remembered, first, that railways are almost always built with borrowed capital, and it is difficult for the average financier to borrow large sums on future expectations; secondly, that we cannot in any case borrow $2,000 per mile as cheaply as $1,000 per mile; and thirdly, and mainly, that the rate of growth in traffic is excessively variable and uncertain. As a deduction from a large body of statistics, the writer would estimate that the growth of traffic will rarely average more than 5 per cent. a year east of the Allegheny Mountains, nor more than 7 to 10 per cent. a year west of them; and this ratio of growth is liable to cease at any time for many years, and at periods when it is particularly inconvenient to pay interest on discounted expectancies. In striking a just balance between all these considerations, and determining their justifiable effect on the alignment, there is abundant room for the exercise of that sound common sense and keen forecast of probabilities which command a ready market in every other field of labor but railway location.

Another consideration which greatly modifies the justifiable present expenditure for the immediate traffic and any expected future increase is when there is a possibility of ADJUSTING THE LINE WITH REFERENCE TO THE CONSTRUCTION OF FUTURE IMPROVEMENTS, WHEN TRAFFIC SHALL JUSTIFY THEM. It is evident that in this case the probable growth of traffic should be estimated in a very different manner from that adopted in considering the problem above. We were then estimating the maximum limit of *present expenditure;* and it was proper that our estimate should be exceedingly conservative, but by building, instead of any given line, A, a cheaper and temporary line, B, with reference to the future construction of a still better line, C, we effect a *present economy*, and in considering the expediency of this course we may properly adopt the largest probable estimate of growth of traffic. If there is any *reasonable chance* that business will increase so fast that at any given time in the future it will be advisable to construct the line, C then if the present saving effected by building a cheaper line, B, will, at compound interest, outweigh the loss yearly accumulated from operating the cheaper line in the meantime, we shall be justified in adopting it instead of the more costly line A; and yet it might easily be that, if we had A and B alone to choose from, we should unhesitatingly adopt line A.

* The writer would suggest, however, that any such investigations must be made with great care, and extend over a considerable period of years, to be more trustworthy than those given in this volume.

The possibility of this course is one of very frequent occurrence on every survey, and it is always advisable, *a priori*, for it tends to prudence and present economy. A theoretically correct solution of the problem is very easily reached. We require only to determine:

1st. *The number of trains which will be required to justify the construction of line C*, and the probable number of years within which that traffic may reasonably be expected.

2d. *The difference in operating value of lines A and B*, per daily train. This difference, *multiplied by the estimated number of trains at the time when the construction of line C will be advisable, and by the estimated number of years until then*, will give, approximately, the aggregate loss during the given period in operating the cheap line B instead of line A, with compound interest charged upon it. If the rate of interest be the same as the estimated ratio of growth of traffic, it will give it *exactly;* if the rate of interest be *less* than the ratio of growth of traffic (as would usually be the case), it will give somewhat too small a sum; while, if it be greater than the ratio of growth, the amount given will be somewhat too large; but the differences are not very important.

3d. We require to determine *the difference in cost of construction between lines A and B*, as determined from the comparative surveys, and also the amount of this difference at the end of the given number of years, compounded at a rate of interest representing the fair value of money to the company. The formula for this computation is given beneath Table O.

These few and simple data determined, the problem is solved. If the latter sum exceeds that determined above it, the construction of the cheap and temporary line is probably advisable; otherwise, not. There can, of course, be no approach to certainty in estimates based wholly on a guess at the probable course of future events; but the more difficult it is to reach absolute correctness the greater need we have of *some* guide which shall reduce the unavoidable guesswork to its lowest terms, and save us from the confusion worse confounded which results from not only guessing at facts but at the effect of those facts. The *system* of location here under consideration, viz., a cheap line for present necessities, located, nevertheless, with especial reference to convenience and economy in future improvements, is almost always the truest economy wherever practicable, and highly conducive to the present and future prosperity of the line; and although we cannot determine the exact balance of advantages with the same degree of certainty as in providing for known requirements, yet we *can* assure ourselves that we are not stepping over the limit in either direction, which gives a certainty of error. Due judgment and caution require that we should do so.

Supposing all these questions to which we have alluded to have been thoroughly investigated and decided,—and for any important railway they might well occupy a year's time of an able and competent investigator—the engineer who follows the method of this book will then be able to condense all his data into a nutshell, by drawing up a pocket-memorandum for the guidance of location, in something like the following form:

TABLE P.

GIVING A SYNOPSIS OF NECESSARY DATA FOR THE CORRECT CONDUCT OF LOCATION.

Preliminary Estimate of probable rate of maximum grade:

Going East, ... feet per mile
" West, ... " " "

(Selecting those grades which, by a rude guess, seem most probable and advantageous as a basis for the guidance of surveys and estimates.)

Assumed weight of Engines:

Freight engines, ... tons gross, ... tons on drivers.
Coal " , ... " " , ... " " "

(See page .)

Estimated disproportion in traffic:

Through freight, 1 ton East to ..... tons West.
Way " , 1 " ..... " "

Corresponding disproportion in total wt. of trains (freight and cars)

Through freight trains, 1 to .....
Way " " , 1 " .....
Mineral trains , 1 " .....

Corresponding maximum length of average trains:

Through freight trains, ... cars, ... feet total length
Way " " , ... " , ... " " "
Mineral " " , ... " , ... " " "
Passenger " " , ... " , ... " " "

(See page Table XXV.)

Estimated Extent and Character of Train Service on the basis of the above Statistics:

Classes of trains.	No. of each class daily.	Estimated cost per train-mile. For "Line Expenses" only.	Estimated cost per train-mile. Total of all expenses (p.)	Equiv't No. of trains at $1 per train-mile
Passenger	.....	$.....	$.....	.....
Way Freight.....	.....	.....	.....	.....
Through Freight.	.....	.....	.....	.....
Mineral.....	.....	.....	.....	.....
Totals	.....	.....	.....	.....

Assumed rate of interest on capital, ... per cent.

Estimated Ratio of Increase in Traffic:

Minimum probable ratio, for estimates which involve an *increase* in present expenditure, ... per cent. per year.

Maximum probable ratio, for estimates with reference to adjusting the line for future improvements, involving a *decrease* in present expenditure, ... per cent. per year.

(See pages and .)

VALUATION OF DISTANCE.

One mile or less,	$..... per mile;	$.....	per foot.
From 2 ± to 5 ± miles,	$..... " "	$.....	" "
From 5 ± to 20 ± miles,	$..... " "	$.....	" "
From 20 ± miles,	$..... " "	$.....	" "

(See Table A., page 27.)

(From these values are to be deducted a certain proportion or the whole of the following:)

Capitalized value of the estimated gross yearly receipts per mile (or per foot) from that portion of way traffic the receipts from which vary directly with the distance hauled. $..... per mile; $..... per foot.

(See page 25.)

VALUATION OF CURVATURE.

In 2° curves or less, $.... per degree, more or less, in the curve.

In 2° to 8° ± curves, $.... per degree, more or less, in the curve.

In 8° to —° curves, $.... per degree, more or less, in the curve.

(See Table B, Page 43.)

(The writer's own personal view is that these valuations are independent of radius, at least for all curves of less than 8° or 10°; always provided that the *limiting point* of curvature be not exceeded, and that all curves sharper than 2° be properly eased off at the tangent points—as all curves should be—in a manner which it would be foreign to the purpose of this volume to discuss. See page .)

Value of avoiding a curve altogether = [No. of degrees in curve + degree of curve × 4] × valuation of 1°, as determined above.

(This rule is offered as a fair estimate. It assumes that the cost of the curve (whether it be long or short) extends 200 feet beyond the tangent points.)

Value of lengthening short tangents = Value of the greatest number of degrees of curvature which is covered by the average train standing on the tangent.

(This also is a rule of thumb; but it appears to the writer a very fair rule. The value given for an increase of tangent is greatest in the case of the technical reversed curve, and thence gradually decreasing till the tangent is a train length long, when it ceases altogether. For "broken-back curves" (those curving in the same direction and connected by short tangents) the values given may seem high, but in the writer's view none too high. On the other hand, for the technical reversed curve the values given are far too low. In the writer's view such curves should never be introduced on the "open road" under any circumstances—the objection to them being, not the change of direction in itself, which involves no loss of power over a continuous curve to a train in slow motion on a track transversely level; but the abrupt change in cant of track. To taper out this cant properly there should be a tangent at least 50 feet long per degree of curvature—which any good trackman will speedily throw into a gentle curve. By shortening radii such tangents can almost always be obtained, to the great advantage of the line in every way.)

Cost of breaking up long tangents (exceeding two train-lengths) = Cost of 4° of curvature + No. of degrees introduced.

(This rule assumes the curve introduced to be a 1° curve. The writer commends it to the careful thought of those who may have a leaning toward that most prevalent and foolish practice of incurring expense (often considerable expense) for the sake of securing long tangents. The *distance* lost by a considerable swerve in a long tangent is absolutely inconsiderable.)

Preferable Degree of Curvature, all other things being equal, = $\frac{50°}{\text{No. of cars in average train.}}$

(The above rule is the net result of an analysis which the writer intended to give more fully. It is submitted without further comment or justification. The writer is personally convinced that the curve thus indicated is more economical than a longer and flatter one.)

VALUATION OF RISE AND FALL.

On grades of 0.3	per 100 feet, or less,	$.....	per foot.
" " " 0.3 to 0.5	" " "	$.....	" "
" " " 0.8	" " "	$.....	" "

(etc., etc., as in Table C., p. 64.)

Reduction in RATE *of Minor Gradients:*

(A little table may be made up in the form above from the foot-note to Table C.)

Cost of Breaking up Grades:

(A *convex* angle in gradients, if properly rounded off with an easy vertical curve, may be considered as adding little or nothing to operating expenses. The rail-wear diagrams of R. Price Williams (Proc. Inst. Civ. Eng., Vol. XXV., 1866) indicate that the wear is even less than on a straight grade, but this is improbable.

All abrupt *concavities* in gradients increase wear and tear of rail (and hence of rolling stock) *very largely*, as is abundantly well established by any amount of evidence; but if all such angles be properly rounded off with *long and easy* vertical curves, the increased wear of rail is too trifling for estimate or consideration. A neglect of this simple, inexpensive and effective precaution is one of the most prevalent and inexcusable of all minor errors in railway location. No change in rate of grade exceeding 0.1 per station is ever necessary, nor should it be permitted.*)

VALUE OF REDUCING THE RULING GRADES.

Advisable balance of ruling grades:

Grades assumed above as practicable.

		say 40 ft. per m. going E.	& 60 ft. per m. going W.
Bal'nce for through fr't traffic..	{ 40 or —	" " "	& — " " "
	{ —	" " "	& 60 " " "
" " way " "	{ 40 or —	" " "	& — " " "
	{ —	" " "	& 60 " " "
" " mineral " "	{ 40 or —	" " "	& — " " "
	{ —	" " "	& 60 " " "
" " pass'ger " "	{ 40 or 60	" " "	& 60 " " "

(See Table G, page 110).

* Nothing is easier than to fudge in a vertical curve off hand while writing down the grades, as follows:

1st. *Make the length of each tangent in stations = half the difference in rate of grade in tenths.* This gives us the two tangent points of the curve.

2d. *Beginning at the first full station inside of either tangent-point* (it does not matter exactly where), *decrease the* RATE *of grade to that station from the preceding by .05. Decrease this rate of grade by 0.1 successively between each of the succeeding stations.*

This process will fetch us around into the other grade at the other tangent-point at the proper elevation; with the exception that the *whole* curve will occasionally be from 0.01 to 0.04 lower than theory requires. This error results from the neglect of fractional stations, and is wholly unworthy of attention.

3d. The middle ordinate on such curves is always 0.025.

For the benefit of those who fancy that the radius of a 1° curve is 5729.65 feet, the writer will add that the curve given by this rule is a true parabola, and not some common curve, unworthy of a scientific man. It might more properly, however, be called the *trackman's* curve, for it will always be one which the locomotive will ride over without knowing it.

Value of reducing each of the assumed ruling grades, for each class of traffic:

	Going E. (40 ft. per m.)	Going W. (60 ft. per m.)
For passenger traffic		$.....
" through freight traffic	$.....	or $.....
" way "	$.....	" $.....
" mineral traffic	$.....	" $.....
Total value of reducing each rate of grade	$.....	$.....

(A value for each class of traffic will appear only on one side of the above, which side is shown by the advisable balance of ruling grades. See Tables E and F, pages 92 and 94; also pages 93 and 96.)

Limit of maximum curvature permissable on a level, with a certainty of no limiting effect on trains:

For mineral trains..... ° curves.
" freight " ..... ° "
" passenger " ..... ° "
(See Table M, p.)

Cost of exceeding the limiting point of curvature:

For mineral trains, $....per degree of curve sharper than..° curves.
" freight " $.... " " " " " ..° "
" passenger " $.... " " " " " ..° "
(See pages)

Graduated scale of adjustment between ruling grades and curvature:

(In the form set forth in Table N, page —; modified according to the limits adopted.)

ASSISTANT ENGINE SERVICE.*

Capitalized cost for passenger traffic, $..... per mile of grade worked with assistant engines.

Capitalized cost for freight traffic, $..... per mile of grade worked with assistant engines.

Capitalized cost for mineral traffic, $..... per mile of grade worked with assistant engines.

(See Table L—1, page 120, also pages 116–119.)

Equivalent grades, if worked with assistant engines, to the given maximum grades:

(See Table K, page 115. These grades can only be determined in the field, as occasion arises. The possibilities of combination are infinite.)

Valuation of curvature } *on grades worked with assistant*
Valuation of Rise and fall } *engines:*

(The valuations of these items may be considered as very nearly doubled by the double number of engines, notwithstanding the fact that the number of cars remains the same. Except for the space required, it might be fully demonstrated, as the writer believes, that this rule is very nearly correct, as is also the similar rule given on page 157. They are not merely short rules of thumb, but are thought to preserve a very accurate balance between various economic considerations.

The addition to the *valuation of distance* is given directly by the cost per mile of assistant engine service above. It will be seen that this valuation also has the effect of doubling the ordinary valuation of distance over the remainder of the line, although the car-service remains the same.)

Limit of Minimum Radius on grades worked with assistant engines: ....° curves on a level.

(This limit is evidently different from the limit for the rest of the line. The higher the grade the shorter the permissable radius on a level. By using a "pusher" the train is, in effect, cut in two. The curve required is given by Table M, p.)

Cost of Exceeding the Limiting Point of Curvature:

(This is at least doubled by assistant engines, but it can be rarely or never necessary.)

EQUATING RATIOS.

(An extended list of equating ratios, showing the comparative value of distance, curvature, rise and fall, reduction of ruling grade, assistant engine service, reduction of limiting radii, etc., may be made up from this volume, if the reader chooses to do so, by consulting the index. In the writer's view it is better not to use such ratios at all, giving preference to definite money values).

ESTIMATED PRICES FOR CONSTRUCTION.

Earth excavation,	$..... per cubic yd.
Rock "	$..... " " "
Masonry (of various classes),	$..... " " "
Bridging (" " length, etc.),	$..... " " "
Tunnelling,	$..... " c. y. or lin. ft.
Piling,	$..... " lin. ft.
Track and tracklaying,	$..... " " "

etc., etc., etc., etc.

(These prices determined, an enormous amount of labor may be saved by making up a table of deductions from them in such form that *all estimates of quantities may be made directly from them* IN DOLLARS AND CENTS. This method is highly economical of labor, is equally convenient in balancing cuts and fills, gives almost entire immunity from gross error, and (more than all else) instantaneously and inevitably impresses upon the mind of the engineer the *financial effect* of any differences in alignment he may propose and *obliges* him to base his judgment and decisions at every step on the hardpan of financial fact. The *cost* of the work is what we care about in conducting location, and not the amount of it. On construction it is different. Any engineer who will once *try* the experiment of making his surveys and estimates on the dollar basis exclusively will never use any other. It is evident that such values may be reconverted into quantities at any time, as easily as *vice versa*.)

Cost of excavation:

Depth of cut.	Cost per station.	Difference for 1ft.
1 ft.	$	$
2 "		
3 "		
4 "		
5 "		
Etc.	etc.	etc.

(This table should be made out for every foot of center height—it can be made out from any of the tables of quantities in common use, or by separate calculation—and a similar table prepared for each class of material and each different road-bed. If the last column (which varies by a constant difference) be made up first, such tables may be computed in a few minutes. In making up tables for fills an allowance of 10 per cent. should be included for shrinkage.

If the line be so rough that estimates from center-heights only are not sufficiently accurate, Trautwine's diagrams may be used with the tables to reduce to level section, or the diagrams given in the writer's work on the Computation of Earthwork will give quantities in cubic yards or dollars and cents for sections having one, two, three or four surface slopes direct from the field notes. The inconvenience and delay of plotting sections for preliminary estimates is wholly unnecessary, on all but the raggedest cliff work.)

Cost of Culverts:

6 feet arch culverts, $..... × center-height, + $.....
10 " " " , $..... × " + $.....
3 " box " , $..... × " + $.....
etc., etc., etc., for each class of structure.

(Design a culvert of each style proposed under a fill of say 10 feet from the natural surface) and estimate its cost complete. Determine the cost of lengthening it 3 feet (or 2 feet) if under a fill of 1 foot deeper. This gives us the *first* value above, which varies with the center height. Multiply this sum by 10 and subtract the product from the total cost of the culvert. The algebraic remainder gives the *second* sum above, which is a constant independent of length.

When the culvert is askew or on a side-hill, the center-height should first be divided by the cosine of the angle between the axis of the culvert and a vertical plane through the center line, as a sufficiently close approximation.)

Cost of Bridge Piers: $..... + $..... per ft. of height + $..... × height².

(Any bridge pier may be resolved into certain parts independent of height, a rectangular solid varying directly with the height, and a pyramid. With piers battered ¼ in. per ft., the last valuation above, at $10 per cubic yard, would be only $0.0103. For a pier 10 feet high this gives $10.30; for a pier 100 feet high, $10,300. The cost of bridge abutments, open culverts, and pile or other foundations may be expressed in general form in precisely the same way.)

Cost of Wooden Trestles:

$..... per lin. foot of trestle at grade line.
+ $..... " " " " " 10 ft. ± below grade line.
+ $..... " " " " " 20 ft. ± " " "
+ etc., etc.

(In any wooden trestle every part of the structure above (and including) the cap, and below (and including the *greater part of*) the sill, is directly as the length of the structure and independent of the height. The cost of these portions of the trestle per lineal foot gives us the first line above. The cost of digging foundations, piling, etc., may or may not be included in it. At a certain distance below the cap, say 10 feet, there is a system of longitudinal, transverse and diagonal ties and sway-braces running the whole length of the structure; also 10 feet of posts and batter-posts and (constructively) a certain addition to the length of the sill. All this may be expressed at so much per lineal foot *on a horizontal line* 10 *feet below the grade line*. This gives us the second line above.

Ten feet further down there is a similar system, nearly duplicating the former, and this gives us the third line. So we may proceed till we have provided for the highest trestles likely to occur on the line.

The length of each of these systems below the grade line should be measured a little long on the profile, to allow for any bents which may extend below one system and not quite down to another. At the bottom of the trestle there will be an irregular area of greater or less extent. To estimate this, sketch in by eye a rectangle 10 feet deep and of equal (or somewhat smaller) area. Any one familiar with the construction of trestles will do this with great accuracy.)

Iron Trestles:

$ .... per horizontal foot on the grade line.
$ .... " " " at intervals of .... feet below the grade line.

(Iron trestles are usually let at so much per foot horizontal and so much per foot vertical. To the price per foot horizontal may or may not be added the cost of masonry pedestals. On the Cincinnati Southern Railroad these pedestals have averaged 1.6 cubic yards per lineal foot and extend from 4 to 8 feet or more above the natural surface. The price per vertical foot is very nearly uniform for all heights. On the Cincinnati Southern Railway the average prices were $25 per foot horizontal and $10 per foot vertical, for 30-feet bents. Adding to the former sum the cost of masonry pedestals, say $15, we should have had:

Per foot horizontal, at grade line, $40.00.
" " at intervals of 10 feet, $3.33.

We see here how little the element of height has to do with the cost of trestles. Singularly enough, it appears to have more effect on the cost per foot horizontal than per foot vertical. An allowance for the effect of height may be made in estimating for the irregular area at the bottom of the trestle-profile. It is to be remembered that the trestle is raised above the natural surface by the height of the pedestals.

The above rules are given merely as an illustration of method. They may be amplified into the utmost desired detail with a very slight amount of labor, for, as they are *general* in form it is only necessary to compute a single type of each class once for all, and the Chinese farce of plodding through identically similar calculations over and over again, is then entirely unnecessary. Although these methods may *seem* rude, they are in reality quite as accurate as, and decidedly more trustworthy than, the most careful separate estimates from location notes; and they do away with all temptation to follow the vicious but not uncommon practice of making surveys first and estimates afterwards. To the prevalence of the latter practice we may trace much of our erroneous and wasteful location. It is everywhere and always wholly unjustifiable; and any one who ever has done it or ever would do it may rest assured that his alignment will not stand the slightest economic analysis. In all but the very roughest county it is easier to make up the estimate than to make up the profile, if the engineer be capable of intelligently using labor-saving methods; and in any region where two or three surface slopes are inadequate, then, *a fortiori*, a computer should accompany the party with no other duty than to keep up the estimates. A careful balance of cost and value should accompany every foot of the survey before it is left behind as complete. All of the above estimations may with decided advantage be graphically expressed on a sheet of cross-section paper, but into that question we will not now enter.)

The above table includes all the data which are required for the correct conduct of location, and (with a few occasional exceptions) nothing beyond that. Any engineer may well devote the labor of several weeks or months to filling it out with care and fidelity; and any railway of any importance would be repaid many fold for the expenditure of a large sum in an exhaustive preliminary investigation for that purpose. But if the engineer be disinclined to all this labor, or (more probably) his company be disinclined to pay him for it, he may make a few rough guesses at his localized data and fill up the rest of the blanks from this volume, and still have a *pretty fair* guide. And if he should regard the above table as too extended and detailed for "practical use," even when thus hastily filled up, if he will merely make up from the tables in this volume a few rude approximations to some of the *more important* data tabulated in blank above, and carry them on a card in his pocket-book, it is confidently believed that he will be fairly equipped to make a very decent approximation to the true economy of alignment; or at least will be more likely to avoid falling into those gross errors of judgment which disfigure the alignment of so many railways.

Being thus prepared to make a respectable location, the next thing is to do it. And here we pass beyond the point where this book or any other can be of much service. After all, a book of this kind, however excellent it might be, bears only the same relation to the design of railways than a transit does to the fieldwork: one man will do very good work with a very poor instrument, while another man will do the poorest kind of work with the best instrument ever made. But it is not on record that any man ever made a good survey without even a chain, and in furnishing an instrument of some fashion which may be called relatively good because it is the only one, the writer hopes he may have rendered some real service to an occasional patient reader, and shed some little light on the true economy of location. He has not spared his own labor to do so, but no one can perceive more clearly than himself how far he has fallen short. He can only plead in extenuation at once the necessity and the difficulty of the task he has undertaken; for he does not hesitate to declare his belief—in which he fully believes the reader who has followed him thus far will coincide—that the subject which he has so imperfectly considered is at once the most important, the most intricate, the most neglected, and the least understood of any department of engineering design.

THE END.

*The writer would again urge that the question of adjusting grades with a view to the use of assistant engines should *always* be considered, on cheap and low-grade lines as well as on costly and high-grade lines. The advantages are very often enormous, and the counter-balancing disadvantage of loss from engines standing idle is a trifling objection which appeals more strongly to the imagination than the judgment. If we can so adjust our grades that instead of having two engines at work all the time we can have only one of them constantly at work and the other standing idle in the yard, fully manned and with steam blowing through the safety valve, for 9-10 of the time, have we not effected an important economy?

Bridges and Compliments.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I am aware that humility is a virtue, a sweetness, and that Athenians have it bad, even the Bosto-Athenian and untrammeled vociferator for the liberty of striking unprovoked blows only to get a chance to take up cudgels with an air of aggrievement in his own defense (?), or the Pennsylvania representive of the species who, dripping all over with the sweet virtue, breaks out into such phrases as "to the thoughtful, however," or condescendingly admits that one of nature's laws is a mere principle which can be carried too far by little man.

I would suggest to Mr. Marsh to look over my letter of Feb. 5 again, and really ask himself whether I expressed preference enough to amount to a "hobby," or, in fact, any preference at all, for either contracting engineers, deep trusses or closed columns, or intimated an aversion to other classes of engineers, to shallow trusses or open columns, and having satisfied himself on these points, come forward and state who issued license for his little curbstone show, wherein he holds up Smith as the medicine and another man's bridge as the awful result. I know nothing about the bridge he thus utilizes, but can assure him that buckling of bottom chords by tight laterals in unloaded bridges of moderate span, and depth only sufficient to let trains through, is not at all unusual, is not a proof that the truss is too deep, nor that the chord should be stiffened to resist compression, but is merely one of those foreman's tricks referred to by me in the letter mentioned. Concerning his statement that tight counters assisted in this buckling, I refer him to those numerous builders who first load their spans and then hold them down, not up, by tightening the counters, thus reducing the nominal deflection and giving them a claim for "stiffness."

While Mr. Marsh is still thoughtfully shedding the heavenly dew of his surplus humility upon a thirsty profession, I would call his attention to the fact that the use of closed columns does not necessarily involve that of a cast-iron joint-box or any joint box, and for a couple of prominent but not rare examples would refer him first to the double-deck bridge over the Mississippi River at Rock Island, designed and built by the Baltimore Bridge Company, under contract with the United States. The river portion of the bridge is in three spans of 220 ft., two of 260 ft., and one draw of 365 ft. The posts are closed Phœnix columns, the top chords of the fixed spans are square closed box columns, and there is neither joint-box nor cast-iron in the structure above the turn-table. The second reference is to the new Kentucky River bridge, designed and built by the same engineering company for the Cincinnati Southern Railway. In this there are three spans of 375 ft. each, and two stone and iron piers which with the truss make a total of 285 ft. height from pier base to rail. The pier columns, end truss posts and both top and bottom chords are closed square box columns, and to forefend the rivet-shriekers against loss of sleep, I will state that the iniquities of pin joints to the diagonals and butt joints to the posts are condoned by riveted joints to the chords, the spans being made continuous for facility in building the bridge out from anchorages without the use of trestle work, and afterwards uncoupled at certain temporary joints to obviate any disturbing action from vertical expansion of the iron piers. There are no joint boxes or cast iron in this structure above the bed plates. It might be thought that when it comes to designing and erecting works like this, or erecting St. Louis arches and some other less prominent feats that might be mentioned, contracting engineers may be allowed to have their uses to the body politic, although there will always be gentlemen who will class these uses with the long list of things which it is not given to them to comprehend.

This brings me around again to Mr. Herschel, and at the risk of overcharging him with information I will state that fully nine-tenths of all the iron bridges in this country have been built by contracting firms and companies which have grown up around men who were in large practice as bridge engineers or contractors before his professional advent, although it is possible that all this would have been different if they had known he was coming. One class of these old companies (relics of barbarism, I presume,) had its beginning in the coalescence of bridge engineers with old wooden bridge contractors, who in time, finding business improving, took in capital or influence, and built works of their own on a stock basis. A second class were the old wooden bridge contractors who built works when iron came into use, had no use for engineers *a la* Ashtabula, smashed, took in new capital and engineers, and succeeded. A third class dates from offers of capital and presidency to old engineers having already a large bridge practice on fee or commission, and shops to carry out their plans became part of their scheme. Still a fourth class are aggregations of engineers with their practice who do not build shops of their own, but form contracts with iron companies to execute their designs in the manufacturing department. These contracts may bind the parties to one another exclusively for a term of years, or may cover only the iron work for single bridges; and with reference to this class Mr. Herschel's discovery of the "middle-man" bug-a-boo may be said to be a "jack in the joint-box," as this class covers the only two concerns of any size which have ever used the cast-iron joint-box elsewhere than at head and foot of end post. The fact that these joint-boxes enter into over twenty-two miles of bridge, or somewhat over three times the aggregate of all the open web riveted bridges in the country, and the professed astonishment at the existence of middle men, although their joint-boxes are so well known and badly belabored, would seem to indicate a somewhat chaotic arrangement of information in the minds of gentlemen who aspire to allay public anxiety by

casting suspicion upon the integrity of nine-tenths of all the bridges (and that of their builders also) over which the dear public daily transports himself and valuable wife and family.

Mr. Herschel asserts that the engineers in these organizations have ceased to be engineers, and by reason of self-interest are no longer competent to advise on bridge construction, although it might appear to an outside observer that if these men, backed by their accomplished results, should see fit to assert that it was the other party who was not competent to advise, the opinion might produce an effect somewhat similar to the one referred to in Stephenson's historical remark about it being "bad for the coo." One of the two larger companies referred to as using the joint-box in much of its work is only partially a contracting company, very much of its work being done on fee or commission; and, in fact, it takes contracts more in the way of an incidental feature in a bridge practice which has existed from before the war, and was kept up with such irregularities as destroying and rebuilding bridges and other military service in war times necessitated. I can speak feelingly of this class of practice, as one of the first military orders I received after my commission, was to turn into guns and artillery tires three spans of Fink truss for the Virginia Central Railroad, which we had not been able to complete and erect before the war rendered iron too precious to be used for bridges.

Mr. Herschel's idea would appear to be that all these engineers ought to withdraw from the various organizations of their own creation, or cease to take contracts which include the engineering as well as the constructing of bridges, and offer their services to railroad companies, cities, etc., as salaried officers, and perhaps he would allow some of them to continue an office practice disconnected with contracts, and perhaps he is right in his last policy; but at all events he has the honor to hold opinions on this subject, and assures the rest of American mankind that sooner or later it must think as he thinks. This tendency of his towards independence and infallibility is beautifully illustrated by his claim that matters would have been bettered any if the Ashtabula joints had been riveted, persisting that that crippled man-trap failed at a *joint*, when the sworn committee of engineers appointed by the Legislature found that the failure was by buckling of either braces or top chord, and Mr. Howland's full published report (from which Mr. Philbrick's figures seem to be taken) shows clearly that it was the top chord.

Mr. Herschel asks the privilege of speaking in professional terms in your columns, and, having got it, he wanders off into some pert jockey-talk vaporings about me, which, as they are even more boomerangy than slangy in their nature, can be trusted to find their way home to roost without so much as a "shoo fly" from me.

He goes on and definitively describes a riveted bridge as one "all of whose joints and connections are formed by rivets," and then, figuratively, arches his spine and "scats" at my mention of tacking diagonals to trough-shaped chords. My exact words were, "prefers the venerable plan of riveted joints and surplus metal in the body of his tension members, double tees in his posts and an unbalanced three-sided open-trough top-chord, to which he tacks on his diagonals with rivets, and makes up for the ambiguity of the strains therefrom by a superabundance of formulæ and much wisdom of demeanor." Now, I propose to add that the posts and lateral systems are also tacked on with rivets, to explain, to persons other than practical engineers, that tacking on is a common shop term applied to rivets in single shear, and then to adhere to it as a full and accurate description of the *best* practice of the *best* designers of open web riveted bridges in Europe and America, and this claim is not at all invalidated by failure of my language to describe Mr. Herschel's practice any more completely than "wisdom of demeanor" applies to his jockey talk. Neither is it damaged by any one's omission to add the words "too worthless to mention" to an enumeration of "British tubular monstrosities," Calcott Reilly's devices, and an unnamed variety of web members as being "too numerous to mention."

The fact is that many more riveted bridges would be built in this country were it not proven by long experience and study on both sides of the Atlantic that the superior sectional shapes for compression members in all their nice gradations of areas cannot be satisfactorily connected by riveted joints, and the American mind *in general* refuses to believe that a double tee or unbalanced trough-sectioned compression member will *legitimately* stand more than one-half to three-fourths as much working strain per square inch as a closed circular or square column, and the accuracy of this statement is not impugned by the fact that some builders have built and some railroads have purchased bridges containing the inferior shapes under an impression that a compression limit of 8,000 lbs. is equivalent to a safety factor of 5. It is a little singular that if riveted bridges are as cheap as pinned and tenoned work the rivet men should be so uniformly unsuccessful in competitions where experimental proof of the assumed strength of compression members is required by the specifications.

There are also some considerations to be mentioned in connection with the very strong point advanced about the infrequency of failures in riveted bridges. If this claim were not based upon observed facts on both sides of the Atlantic, it could safely be scouted upon the ground that in this country the entire aggregate of such bridges does not make up a class large enough for the failure percentage to have reached; but however this may be it is a fact that riveted bridges among us are confined almost entirely to New England and the more thickly-settled portions of New York; that they are also almost entirely on old lines of road which have been through all the grades of accident until they are manned by experts *and their road departments* as in Europe are *under the control of engineers;* that these engineers have studied the problem of bridge floors and the much more important one of approaches to bridges, which latter problem is hardly yet taken hold of in the West and South. I know of only four clean knock-downs among recent bridge failures, and all four of these were the result of derailment, breakage of axle, or rear collision taking place, not on the bridge, but on the approaches; and in this connection I desire to urge the necessity for immensely stiff end panels of bottom chord in through bridges with vertical end posts. There are many of these end posts in this country which a very slight blow would suffice to knock off the masonry and fold up under the top chord; and I know of one case where a heavy 15-inch rolled beam in an end panel was curled up like so much paper by a fast train undertaking to mount and ride over a construction train going in the same direction, and butting into the vertical end post of a bridge in its efforts. It would seem that an inclined end post is the safer plan as a rule, although I know of a Phœnix column inclined post of 20 inches section or thereabouts in a bridge of my own design which was cut in two by a fast train jumping the track on the bridge approach at the foot of a long grade. If there is anything that causes me a loss of sleep, it is to begin the evening with thoughts about the condition of the approaches to some of my bridges. The Western bridge floors are very much better than those in the East, while Eastern bridge approaches are very much better than those in the West. In the North and East the towns are mostly on the banks of streams, the bridges are in the suburbs where even fast trains are slowed by municipal regulation; whereas in the West and South the towns are set back on the hills to avoid miasma, the bridges are at the grade bottoms between stations, and are crossed at speed rendered speedier by the tendency of engine-men to "pull her out" on the down grade so as to get help on the hill.

Before closing I desire to say that in many cases of cast-iron joint-box construction, particularly where square closed columns are used, there is a strong tensile connection carried throughout the chord by a system of splices of plate or channel iron, passing through and forming the tenons of the joint-boxes and attaching to the chord columns by means of turned bolts, the same feature being used in the posts sometimes. In some cases the tops and bottoms of the joint-boxes are wrought-iron plates, the cast iron thus being reduced almost to mere pin washers.

FRED. H. SMITH, C. E.

BALTIMORE, Md., March 7, 1877.

Testing the Weld Between Cast-Iron and Steel in Steel-Tired Car Wheels.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I beg leave to state through the *Gazette* that the statement made by Mr. Clark Fisher, contained in the *Gazette* of Feb. 23, to the effect that you do not know, in the manufacture of car wheels having steel tires and cast-iron centers welded together, whether the metals are welded or not, because you do not harden them, is wholly incorrect, and I presume from lack of experience on his part in making the wheel referred to. The facts are these: At present there is not to my knowledge any flux used as he states, and also that "we do know" positively in every instance before the wheel is sent out whether we have a perfect weld or not, simply by turning the edge of the tread of the wheel, which is now done in all cases. Therefore, if the weld is perfect, when the tool reaches the junction or union of iron or steel, the turnings even on the extreme edge of the wheel, as they leave the tool, being part steel and part cast iron, in a perfect weld will stick firmly together and be inseparable, even though they may be not more than a 64th part of an inch in thickness. On the other hand, if there is not a perfect weld, the iron will invariably be separated from the steel in the turnings as they leave the turning tool, thus making a sure means of detecting any imperfections in the weld. So finding a perfect weld on the outer edge of the tread is a sure indication of a perfect weld in the centre of the tread of the wheel.

J. K. SAX (Patentee).

Specimen Locomotive Report.

Annual statement of expenses for the year 1876 of the machinery department of the Missouri, Kansas & Texas Railway. Made by G. W. Cushing, Superintendent of Machinery, to the Union Trust Company, of New York, Trustee.

STATEMENT NO. 1.

Performance of Locomotives.

No. miles operated	736
Train engines are not allowed switching mileage.	
Switch and construction engines are rated at six (6) miles per hour when in actual use.	
No. engines in revenue service	52
" " " switching service	9
" " " construction service	4
" " " shops for repairs	3
Total No. of engines	68
Total mileage	2,382,483
Tons coal used	72,068
Gallons oils used	22,973
Cost of repairs	$108,674 04
" " wages	148,609 56
" " oils and waste	11,352 30
" " fuel	162,016 39
Total	$430,652 29
Cost per mile for repairs	4.56 cts.
" " " " wages	6.24 "
" " " " oils and waste	0.48 "
" " " " fuel	6.80 "
Total	18.08 cts.
Miles per ton of coal	33.06
" " pint of oil	12.96
Coal charged at $2.24½ per ton.*	

STATEMENT NO. 2.

Cost of **Train Engines** *per train mile.*

Three empty cars rated as two loaded cars.

Engines employed	52
FREIGHT TRAINS.	
Total train miles	1,229,970
Average loaded cars per train	14.78
Cost per train-mile repairs	5.62 cts.
" " " wages	6.37 "
" " " oils and waste	0.54 "
" " " fuel	8.63 "
Total cost per train-mile	21.16 cts.
PASSENGER TRAINS.	
Total train-miles	736,183
Average cars per train	4.58
Cost per train-mile repairs	4.69 cts.
" " " wages	5.83 "
" " " oils and waste	0.43 "
" " " fuel	5.60 "
Total cost per train-mile	16.55 cts.
Grand total cost train engines	$382,055 13
Tons coal used	66,131
Average number miles run per revenue engine per day	104
" " " " " " month	3,151
" " " " " " year	37,811

Cost per car hauled one mile.

TRAIN ENGINES.

Total loaded freight cars hauled one mile	18,180,205
Cost per car repairs	0.36 cts.
" " wages	0.43 "
" " oils and waste	0.04 "
" " fuel	0.56 "
Total cost per car hauled one mile	1.43 "
Pounds of coal per car per mile	8.97
Total passenger cars hauled one mile	3,372,651
Cost per car repairs	1.02 cts.
" " wages	1.27 "
" " oils and waste	0.10 "
" " fuel	1.32 "
Total cost per car hauled one mile	3.61 "
Pounds of coal per car per mile	19.26

STATEMENT NO. 3.

Cost of **Switch Engines** *per train mile, and per car one mile.*

EXPENSE DIVIDED ⅚ TO FREIGHT AND ⅙ TO PASSENGER TRAINS.

Cost per mile freight train	2.01 cts.
" " car hauled one mile	0.13 "
Total cost of switching engines	$33,223 26
Cost per mile passenger train	1.16 cts.
" " car hauled one mile	0.25 "
Engines employed	9

Cost of **Work Train** *Engines.*

Cost per mile freight trains	0.83 cts.
" " car hauled one mile	0.05 "
Engines employed	4
Cost per mile passenger trains	0.70 cts.
" " car hauled one mile	0.15 "
Total cost of work train engines	$16,373 30

STATEMENT NO. 4.

Total cost of **All Engines per Train Mile** *and per car hauled one mile.*†

Cost per freight train mile	24.00 cts.
" " " cars hauled one mile	1.62 "
" " passenger train mile	18.41 "
" " " car hauled one mile	4.09 "
Water service and fuel stations not included	$28,747 99—1.46 cts. per mile
Credit, old scrap sold, etc., included	8,733 85—0.44 " "

STATEMENT NO. 5.

Cost of Freight and Passenger Car Repairs **per Train Mile,** *and per loaded Car hauled one mile.‡ Three (3) empty Cars rated as two (2) loaded Cars.*

FREIGHT.

Loaded cars per train	14.78
Total mileage of trains	1,229,970
Cost per train mile	8.54 cts.
Total mileage loaded cars	18,180,205
Cost per car per mile	0.58 cts.
Total cost freight car repairs	$105,023.43

PASSENGER.

Cars per train	4.58
Total mileage of trains	736,183
Cost per train mile	9.54 cts.
Total mileage of cars	3,372,651
Cost per car per mile	2.08 cts.
Total cost passenger car repairs	$70,210.55
Cost of Pullman car repairs, per car per mile	2.24 cts.
Total miles Pullman cars	406,089
Total cost car department	$175,233.98

All expenses of car department are included in this statement.

J. C. BARBER, Master Car Builder.

TOTAL COST LOCOMOTIVE AND CAR DEPARTMENTS.

Expenses, locomotives	$430,652.29
Maintenance cars	175,233.98
Total	$605,886.27
Total cost per train mile—freight	32.53 cts
" " " " passenger	27.94 cts.
Total cost per car hauled one mile—freight	2.20 cts.
" " " " passenger	6.10 cts.

Car mileage correct.

E. W. BRUNDAGE, Car Assistant.
S. T. PAGE, Chief Clerk Mach. Depart.
G. W. CUSHING, Sup't Machinery.

*Wood is reduced to coal: 1½ cords is called 1 ton.

†In this statement the cost of switch and work train engines is charged ⅔ freight and ⅓ passenger. No credit is taken for mileage of switch and work train engines. Three (3) empty cars are equal to two (2) loads. The cost of fuel consumed includes that used by switch and work train engines.

‡This statement includes the total expenses of repairs to all cars, also renewals and stores furnished for maintenance, etc.

ANNUAL REPORTS.

Chicago & Alton.

This company's report for the year ending Dec. 31, 1876, reaches us too late for more than a few brief notes this week.

The road worked includes 677.84 miles of main track, of which 365.38 miles are owned and 312.46 leased. The road owned has been increased by the purchase and construction of the Coal Branch, 3.98 miles, and that leased by the Chicago & Illinois River road 23.86. There has been an increase of 12.72 miles second track, all between Chicago and Joliet, and of 6.64 miles of sidings.

The stock at the close of the year was $12,490,800, an increase of $127,600; the funded debt $8,629,850, an increase of $486,650.

The work done during the year was as follows:

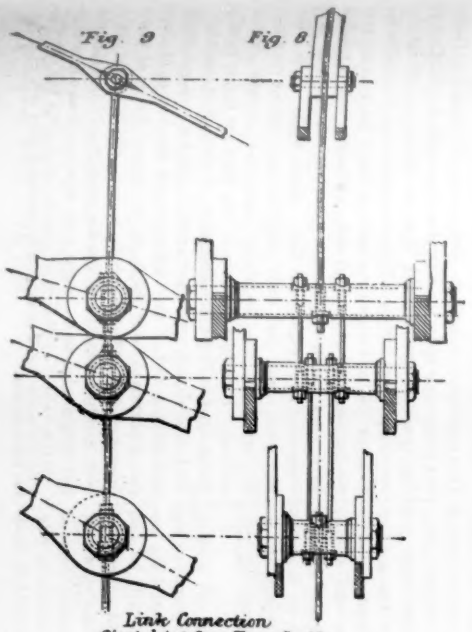
	1876.	1875.	Inc. or Dec.	P. c.
Passenger train mileage	924,398	945,950	Dec.. 21,552	2.3
Freight train mileage	1,537,067	1,362,023	Inc.. 175,034	12.9
Total revenue train mileage	2,461,455	2,307,973	Inc.. 153,482	6.6
Passengers carried	873,873	862,264	Inc.. 11,611	1.3
Passenger mileage	41,231,777	39,913,851	Inc.. 1,317,926	3.3
Tons freight carried	1,818,235	1,545,802	Inc.. 272,433	17.6
Tonnage mileage	217,835,161	168,923,879	Inc.. 48,911,282	29.0

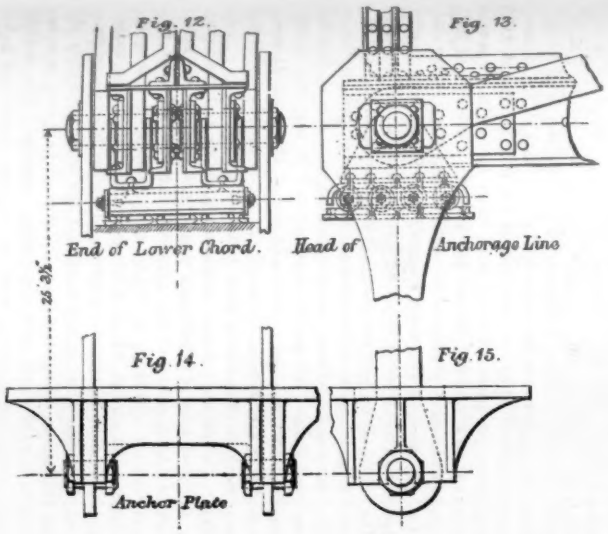
The earnings from this traffic were as follows:

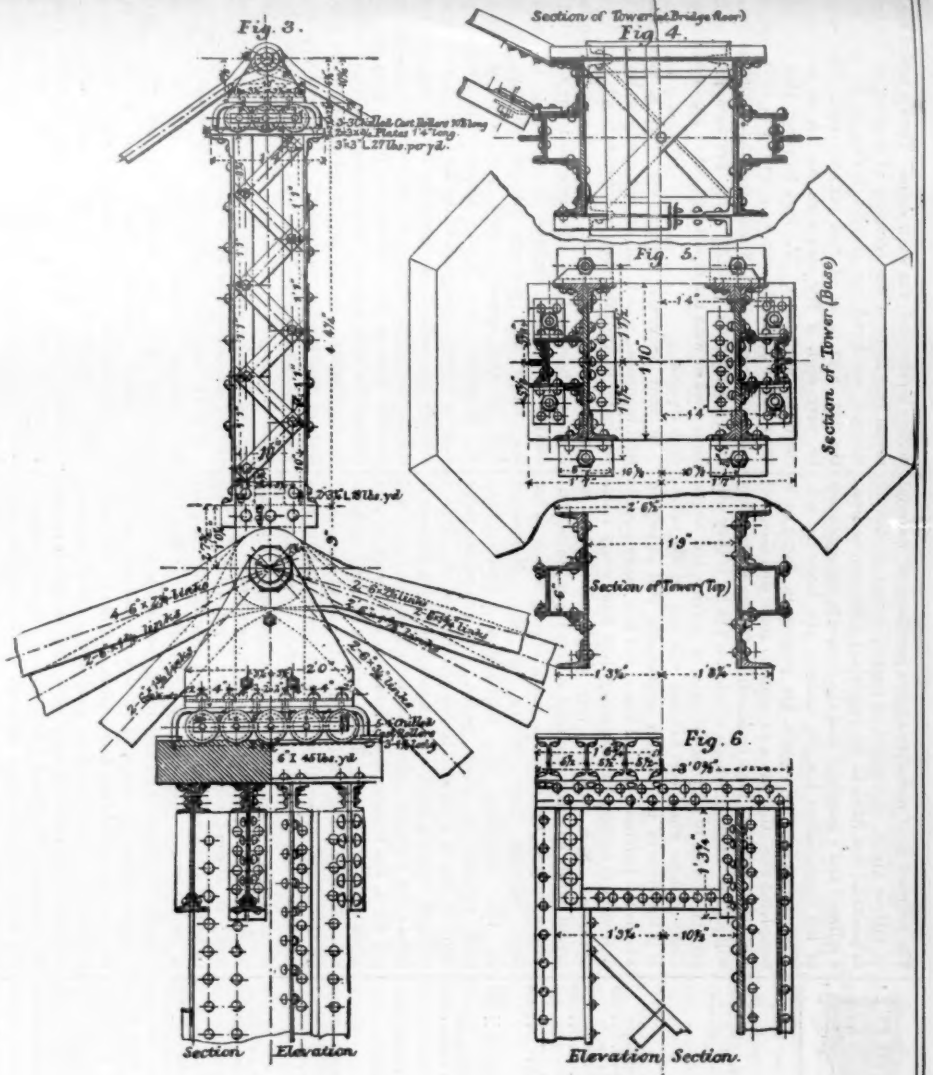
	1876.	1875.	Inc. or Dec.	P. c.
Passengers	$1,218,820 91	$1,252,688 77	Dec.. $33,867 86	2.7
Freight	3,541,346 07	3,173,531 43	Inc.. 367,814 64	11.6
Mails	97,969 00	96,192 36	Inc.. 1,776 64	0.3
Express	98,963 33	98,880 37	Inc.. 82 96	....
Miscellaneous	3,429 38	35,470 90	Dec.. 32,041 52	90.3
Total	$4,960,528 69	$4,656,763 83	Inc.. $303 764 86	6.5
Working exps	2,691,061 11	2,604,125 34	Inc.. 86,935 77	1.3
Net earnings	$2,269,467 58	$2,052,638 49	Inc.. $216,829 09	10.6
Gross earn. per mile	7,318 14	7,164 25	Inc.. 153 89	2.1
Expenses per mile	3,970 05	4,006 34	Dec.. 36 29	0.9
Net earn. per mile	3,348 09	3,157 91	Inc.. 190 18	6.0
Per cent. of expenses	54.25	55.92	Dec..	1.67	3.0

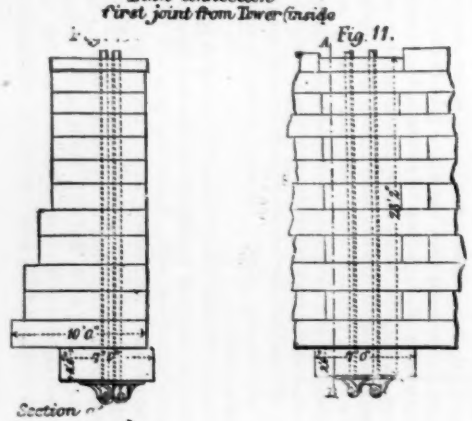
There was a decrease of 0.017 cent. in the average rate per passenger per mile, and of 0.252 cent. in that per ton per mile.

The total expenditure for improvements during the year was $397,073.27, the principal items being $103,535.99 for new second track, and $144,607.84 for additional cost of steel over iron rails. There were 87.96 miles of steel laid during the year making 384.4 miles of track laid with steel. The usual dividends (8 per cent.) were paid.









DETAILS OF THE

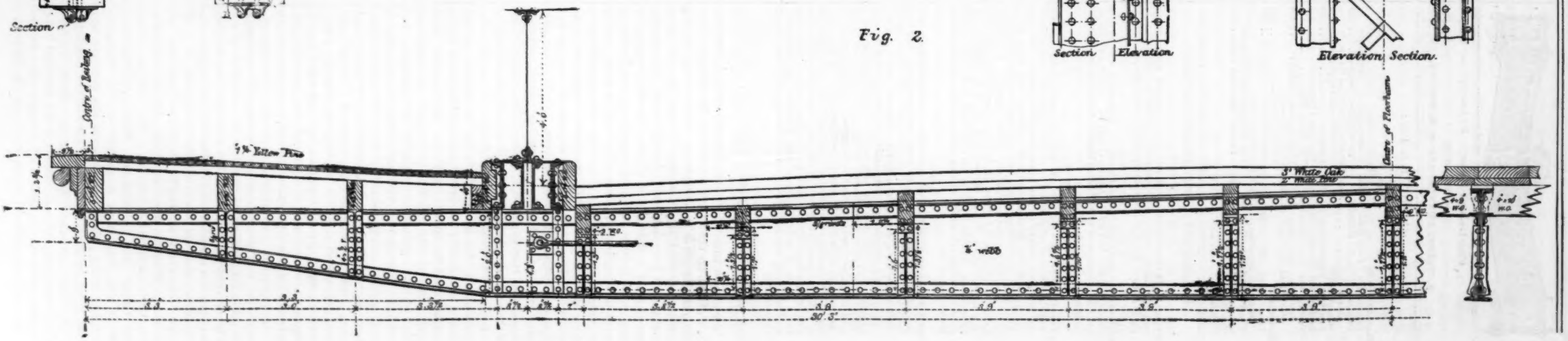
CARRIAGE BRIDGE OVER THE PENNSYLVANIA RAILROAD,

At Fortieth Street, Philadelphia.

Designed by Joseph M. Wilson, C. E.

[A perspective view and description of this bridge may be found in the *Railroad Gazette* for February 16, current year, page 75.]

Fig. 2.



RAILROAD GAZETTE

Published Every Friday.

CONDUCTED BY

S. WRIGHT DUNNING AND M. N. FORNEY.

CONTENTS:

	Page.		Page.
ILLUSTRATIONS:		EDITORIALS:	
Locomotive "John Bull,"..	105	Transportation Legislation in the Last Congress.....	112
Details of 40th st., Philadelphia Bridge.....	109	GENERAL RAILROAD NEWS:	
CONTRIBUTIONS:		Elections and Appointments	113
Justifiable Expenditure, &c.	105	Personal.....	113
Bridges and Compliments..	107	Traffic and Earnings.....	113
Testing the Weld Between Cast-Iron and Steel in Steel-Tired Car-Wheels...	108	The Scrap Heap.....	114
EDITORIALS:		Old and New Roads.....	114
The Value of Accurate Dates and Reports.....	110	ANNUAL REPORTS:	
The Pennsylvania Railroad Report.....	111	Chicago & Alton.....	108
The Decision in the Granger Cases.....	111	Pennsylvania.....	116
		MISCELLANEOUS:	
		The Supreme Court Decision in the "Granger" Cases..	112

Editorial Announcements.

Passes.—*All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.*

Addresses.—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

THE VALUE OF ACCURATE DATA AND REPORTS.

On another page will be found the annual report of Mr. G. W. Cushing, the Superintendent of Machinery of the Missouri, Kansas & Texas Railway, made to the trustee of that line, which is well worthy of examination by those in charge of the machinery of other roads, and also by those higher in authority, or who are directly interested in the profits of railroads. In all branches of business which are at all complicated, those who conduct them find it absolutely necessary to have constantly presented to them such data as will represent clearly the condition of the business, the sources of revenue and the destination of disbursements. Quite curiously, in that branch of business which has grown to larger dimensions than any other in modern times, the precision of the accounts which represent its condition has seemed to be in inverse ratio to the magnitude and diversity of the transactions. The apathy which has for so long a time existed in regard to this matter has doubtless been due to a great extent to a want of knowledge on the part of those highest in authority regarding the business of "railroading." The presidents have usually been selected from successful business men who have nearly always been entirely without any special knowledge of the affairs which they were suddenly called upon to conduct; and often, too, owing to advanced years and fixed habits, with very little aptitude for learning a new business, especially one requiring such extended knowledge as the management of a railroad does, and demanding extraordinary capacity for conducting matters which it is impossible to understand in detail. Take as an example the very common case of a successful merchant placed in the position of president of a railroad at say fifty or sixty years of age. His whole previous training has been in a school whose fundamental principle is to buy cheap and sell dear, a principle which it is of course important to apply to railroads as well as to nearly all other business affairs. In an exclusively mercantile business, however, the buying cheap and selling dear are finalities. When this is accomplished the transaction is completed. The buyer or consumer is the judge of the value of the purchase, and it is alone the buyer's estimate of the value of commodities which the merchant must regard. Their intrinsic value he need not concern himself about, provided there be no deception of any kind in effecting the sale. In the management of a railroad, however, the case is different. The railroad is of necessity a large purchaser of material of various kinds, and ought, of course, to buy as cheaply as possible; but there is the important difference between a railroad and a merchant that the former is the consumer of the commodities bought, whereas the latter is not. When a merchant buys goods, his purpose in doing so is completed when they are sold again to some one else, but a railroad company buys commodities for the service they will render. Thus car wheels which cost $12.50, if they will give an average of only 35,000 miles of service, are not as cheap as those which cost $15 and will run 50,000 miles. It is therefore of the utmost importance that in buying wheels the purchaser should know, not how many pounds of iron he is getting for the money, but how many miles of service. Now even this very simple matter has received hardly any attention from railroad companies until within the past two or three years, during which it has been brought into notice by the discussions at the meetings of car-builders, which have been reported in these pages. A somewhat more difficult case is presented in the purchase of oil. This a railroad company buys, not as a merchant does, because it costs a few cents per gallon less than some one else will pay for it, but because it will lubricate a number of cars while running a greater or less number of miles or days. Now, the lubricating quality of the oil cannot be measured by the gallon, although we are inclined to believe that presidents and purchasing agents often do not know to the contrary, nor can it be weighed in the scales, but must be determined by actual service or experiment. So of fuel; its steam-producing capacity is not determined by its weight alone, and, what is of very great importance but is probably not suspected by many who buy fuel, its capacity for generating steam in a given time is a very important quality, because coal which will make a great deal of steam in a short time may enable engines to take several more cars over the ruling grades of a road than they could if the fuel did not make steam fast enough to supply the engine at the critical point, when a very little more or less makes the difference between getting up the grade and not getting up. The same principle will apply to rails, ties, machinery and in fact nearly everything which is used on a railroad. Now a person educated entirely in buying and selling, and who has for a life-time been accustomed to regard all transactions from that point of view, who prides himself on always buying cheaper than others, and to whom buying cheap and selling dear mean success, is very apt to make sad mistakes, because, as a contemporary has said of some of our public men, "they do not know enough to distinguish between what expenditure is wasteful and what is not. They generally attack official salaries and appropriations for scientific purposes." A ludicrous illustration came under the notice of the writer during the war. On a railroad, which will be nameless, the draftsman made a requisition for some Faber's HHHHHH drawing pencils, which at that time were very difficult to get, and very expensive. The Purchasing Agent of the road had been selected because he had been noted in the community as the most parsimonious, sordid and penurious person in it. When the requisition came and he learned that the pencils cost about fifty cents each, he rose in arms and refused to buy them and sent some ordinary hard writing pencils. The draftsmen used a poor quality of manilla paper—bought by the Purchasing Agent—which had a sort of gritty texture and on which the point of a soft pencil was rasped away almost instantly. Demands and importunity failed to move the Purchasing Agent, until finally, we believe, one of the superior officers interfered in their behalf. In the meanwhile the quantity of poor pencils consumed would have bought two or three times as many good ones, even at their high price, as were needed, not counting the time wasted. This is, of course, a very small matter; but it illustrates what we have tried to make clear, that a passion for buying at the lowest price often defeats all true economy. A railroad manager must employ the means of determining the *value for use* of not only the material and machinery, but of the agents employed. Just as a $12½ wheel may be more expensive than one which costs $15, so a $1,250 man may be much more costly than one who is paid $1,500. It is of course true that paying a person a large salary does not change the man or his qualifications; but if the services of a good man can be secured by good pay, and not without, then it is usually wretched economy to take a poor one at a low price. Now just as it is important to know what service is performed by the car wheels, so it is desirable to have some accurate basis of comparison to determine whether all other service is economically performed.

We have taken occasion heretofore to point out how essential it is, in order to do this, to keep an account of the mileage of cars. On another page will be found the report of Mr. Cushing, already referred to. It will be seen that this report gives not only the usual data concerning locomotives, such as the cost per mile for repairs, wages, oil and waste, and fuel, but it reduces these same items of expense to the cost per car per mile. This makes it possible to make some comparison between the cost of locomotive service and the work done. Thus a report would reveal very little of the economy of working of the locomotives employed on freight trains if it gave only the cost, 8.63 cents, of fuel per mile run. That might be very high if few cars were hauled, or very low if the trains were large. We find, however, that the average number of freight cars to a train was 14.78, and the cost *per car per mile* 0.58 cent for fuel, which makes an exact comparison possible with previous years on the same road or with the reports of other roads which keep such reports.

In many locomotive reports, too, there is often a beautiful vagueness, which, on careful analysis, leaves the investigator in a painful state of doubt as to what the figures cover and what they do not. Mileage of switching engines is one of these, and the allowance made for that kind of service to freight engines is another. Of course the larger the mileage allowed engines, the less will be the apparent cost per mile of service. If therefore one road allows six miles per hour to switching engines while they are in service and another ten, and if one gives five or ten per cent. extra mileage to freight engines for switching at stations and another does as Mr. Cushing has done, gives no extra mileage for that service, then evidently fair comparisons are impossible. In the report referred to, there is very little of that kind of vagueness, but it is distinctly stated what mileage is allowed and what is not, a feature which railroad managers would do well to insist upon in all such reports, because omissions of that kind often cover very glaring inconsistencies and sometimes deceptions.

A very excellent feature in this report is giving the average number of miles run by the engines per day, per month and per year. It is not stated, however, whether this is the average of all the engines owned by the company, or only those in service. It should always be the average of *all* the engines and not of a part only. The economy of getting a large amount of service from engines is now recognized by many locomotive superintendents, but is denied by others. If the average mileage is given, it will be possible to compare the cost of service on roads which make large averages with those on which it is less.

The cost of "water service" is also a new item, but an important one in a locomotive report.

In the car department,, however, the full benefit of keeping the car mileage cannot be obtained without keeping the accounts more in detail. It is of course a good indication of the economy with which this department is conducted to know that all the expenses amounted to 0.58 cent per car per mile for freight, 2.08 cents per passenger, and 2.24 cents for Pullman cars,* but no reason is apparent why a separate account of the cost of oil and waste should not be kept for the car department, as well as for locomotives. If the cost of oil, waste and labor in applying them, and of journal bearings, could all be kept separately, it would soon furnish a very reliable means of determining the value of various lubricants and bearings, and also indicate what size of journal and form of box did the best service. It, too, the report indicated the cost of labor and also of the material used for repairs of cars, it would be quite certain to reveal methods of reducing these items of expense.

The mileage of cars, taken in connection with the number of tons of freight and passengers carried one mile, would at once give the necessary data to determine the average quantity of freight and number of passengers carried per car, which would indicate whether the transportation department is managed skillfully or wastefully. It is also quite as important that the average number of miles run by cars per day, etc., should be given as it is to have the same data concerning engines. The cost of repairs and of oil and waste in the car department is, it will be noticed, about fifty per cent. greater than in the locomotive department, and it is important in the same proportion to know where the money thus expended goes to.

The favorite question of the man who despises knowledge and hates figures is, "What does it all amount to?" It is sometimes difficult to summarize an answer to this, but in the case of such a report as that made by Mr. Cushing, it may at least be said that it enables the officers of the company which is acting as trustee for the railroad to know the facts which we have pointed out relating to the management of the road and a good many others which have not been pointed out. It enables it to compare the expenses this year with those of last year, and, as such reports are issued monthly, compare the expenses of one month with another. It enables the person who buys the fuel to know which kind of fuel is the cheapest. If the wheel report is kept carefully, it would soon reveal which wheels gave the best service, and if the accounts and the reports of the car department were kept in as much detail as was indicated, it could also soon be known which oil was the best, and by an excessive cost for labor show where facilities were needed to do work, and whether it was done as

*It is not stated whether this includes or excludes the cost of maintaining the inside or sleeping appliances of these cars, or only the running gear.

cheaply as it should be. But the great value of keeping reports in detail is, that they often indicate facts and causes whose existence would not otherwise be suspected. The wheel report of the Pennsylvania Railroad, which was presented at the last meeting held in the rooms of the Car-Builders' Association, revealed that the average mileage of wheels under Pullman cars with six-wheeled trucks was 56,523 miles, while under ordinary passenger cars with four-wheeled trucks, with about the same weight per wheel, it was only 39,650 miles. We doubt whether this had ever been imagined by most of those present; in fact, the common impression is that Pullman car service is much more destructive to wheels than any other. Some carefully-kept records, however, soon revealed this unanticipated fact. Other instances could be cited, in which the first intimation we have of a fact is its revelation in carefully kept records. Now to return to the purchasing agent and to the commercial manager of a railroad, what they both ought to do is not to rid themselves of the idea of buying at the cheapest rates, but to unite with that methods of determining what really is the cheapest, to do which nothing is so efficient as careful records of service performed, whether it be by inanimate material or by agents who should be responsible.

THE PENNSYLVANIA RAILROAD REPORT.

The report of the Pennsylvania Railroad Company is always of general interest to railroad men, but this year it is more than usually so, because of the peculiar circumstances. The Pennsylvania Railroad was the main beneficiary of the Centennial. Its passenger traffic was enormously increased last year on this account.

How much it was increased, how far the increase of traffic made up for the decrease in rates, whether the passenger expenses were not increased nearly in proportion to the traffic, so as to leave little room for additional profit from the additional traffic, were questions which could not be answered until the report was issued. We have it now (the President's report only), a week earlier than usual; and it will doubtless be examined closely.

To appreciate the facts properly we should remember that the Pennsylvania Railroad, like others, has suffered from the bad condition of business since 1873. The amount of traffic has not decreased, but receipts have, very decidedly. Meanwhile, there has been little change in mileage. For four years, mileage, traffic, earnings and expenses on the lines worked directly by the Pennsylvania Railroad Company (from Erie and Pittsburgh east to Jersey City) have been:

	1873.	1874.	1875.	1876.
Miles worked..	1,513	1,521	1,574	1,624
Passenger mileage.....	372,048,473	364,392,621	344,234,876	623,208,761
Tonnage mileage.....	1,870,537,537	1,918,796,676	2,026,190,425	2,221,739,198
Gross earnings.	$39,983,139	$37,386,437	$34,464,104	$36,891,061
Expenses.....	27,355,038	25,494,742	21,094,461	22,081,229
Net earnings...	12,628,101	14,891,695	13,369,643	14,809,832

We see here that after 1873 there was a decrease in passenger traffic until 1876, but the increase in freight traffic has been uninterrupted; and counting a passenger equivalent to two tons of freight, the total traffic has grown every year. Earnings, however, were larger in 1873 than they have been since—one-twelfth larger even than they were last year under the stimulus of the Centennial, which nearly doubled the passenger traffic. The notable thing is, that the smallest net earnings were in the year of the largest gross earnings. Last year they were nearly as great as in 1874, and greater than in any other year.

Evidently, however, the Centennial alone saved the company from an unfortunate year. The report shows that there was an increase of nearly $4,500,000 in gross passenger receipts, and but for this increase the total receipts would have been but $32,400,000, and the net earnings but about $12,300,000—or less than in any year since 1872. We may say, then, that the result of the normal business was not satisfactory. It was the abnormal, exceptional business which made the year one of the most prosperous in the annals of the company. It cannot afford to continue to do business on the basis of 1876, no more than any other trunk line. On the Pennsylvania Division, which had last year nearly three-fourths of the freight traffic, the profit per ton per mile was 0.31 cent, and on no other division was it as great. In 1875—a year of unexampled low rates—this profit was 0.442 cent. This decrease in profit of 0.132 cent. is equivalent to a reduction in net earnings on this division amounting to more than $2,000,000. With the freight rates of 1875, the company's profits on all lines would have been nearly $4,000,000 greater. These reductions were very well borne during the Centennial year; but they would be severely felt in an ordinary season.

On the entire system of roads east of Pittsburgh and Erie the average earnings per ton per mile last year were 0.951 cent per ton per mile, against 1.125 cents in 1875, a reduction of 15½ per cent. Freight traffic meanwhile increased 4½ per cent. Since 1873 on the Pennsylvania Railroad Division the average rates have fallen from 1.415 cents to 0.892 cent, or 37 per cent. ; and in that time the freight traffic has increased from 1,384,831,970 to 1,629,762,021 ton-miles, or but 18 per cent. The reduction in expense has been 32 per cent. ; still the profit on each unit of traffic has been brought down 44½ per cent.—from 0.558 to 0.310 cent per ton per mile.

Year after year the margin of profit on freight transportation has been cut down. Expenses have been reduced ; but the decrease in charges has always exceeded such reductions ; traffic has increased, and largely, no doubt, by reason of these reductions in rates ; but the additional traffic does not nearly make up for the reduction in rates. On the Pennsylvania Railroad Division the freight profits of 1876 were $5,052,194 ; in 1873 they were $7,727,362. Yet, as we have seen, the traffic was greater by 18 per cent. in the later year.

This company's experience is by no means peculiar in this matter. The lines whose freight traffic is largely through freight to and from the seaboard have been similarly affected. Rates have been reduced very properly, because expenses were reduced, and to some extent because traffic has increased; but the reductions in charges have been much more than enough to balance. Evidently this cannot continue to go on much longer. At the rate at which freight charges have gone down from 1873 to 1876, before the end of the year 1880 there will be no profit whatever on freight.

If last year the passenger earnings had not been so greatly increased by the Centennial, the available income of this company (including profits on investments, etc.) would have been about $15,000,000, instead of $17,550,000, and instead of a surplus of $1,500,000 after paying 8 per cent. dividends, there would have been a deficit nearly equal to one quarter's dividend. The report seems to demonstrate that 8 per cent. dividends cannot be maintained at last year's rates—or rather at last year's rates of profit—and this is probably true of other trunk lines. It is true that these other lines did maintain their usual dividend payments, and that they had nothing like the advantage from Centennial traffic which the Pennsylvania enjoyed. We do not know, however, just to what extent their business was stimulated by the Centennial, as their reports are for the year ending with September, including but one month of active Centennial travel. The Pennsylvania, it is true, has the lowest freight rates (largely due to its large mineral traffic); but it has also the lowest expenses. Its profit on freight per ton per mile last year was about one-tenth less than the New York Central's, but about one-half more than the Erie's, the figures for the three roads being:

Per ton per mile—	Erie.	N. Y. Cen.	Penna.
Receipt.....	1.099 cts.	1.050 cts.	0.892 ct.
Expense.....	0.885 "	0.710 "	0.582 "
Profit.....	0.214 "	0.340 "	0.310 "

The Pennsylvania's year included two and a half months more of "war" rates; probably the average rates of the other two roads were lower for the same year than for the twelve months actually covered by their reports.

For passenger traffic the corresponding figures are:

Per passenger per mile—	Erie.	N. Y. Cen.	Penna.
Receipt.....	2.102	1.910	1.862
Expense.....	1.854	1.090	1.029
Profit.....	0.248	0.820	0.833

The enormous bulk of passenger traffic on the Pennsylvania naturally resulted in a reduction in the average expense; and the great preponderance of Centennial traffic at low rates reduced the average rate more than on other lines. Heretofore, passenger expenses have been greater on the Pennsylvania than on the New York Central. In 1875 the expense for a passenger *and* a ton of freight was 2.260 cents on the New York Central and 2.285 on the Pennsylvania; in 1876 it is given as 1.800 cents on the Central and 1.611 on the Pennsylvania. The latter's expense per passenger per mile was reduced nearly 40 per cent.—due doubtless to the enormous train loads carried to and from the Centennial. We are not able now to say what the increase in train-loads was, as the President's report does not give train mileage, and the General Manager's report is not yet issued. It will be interesting to examine this, as some indication of the loads required to make it possible to carry at a cost of about one cent. per mile.

The improved financial result of the lines worked by the company did not extend to the vast net-work west of Pittsburgh controlled by the Pennsylvania Railroad Company through the Pennsylvania Company, for the rental of which the railroad company is responsible, though there must have been a considerable increase of traffic on those lines. The earnings and expenses of this system for two years have been:

	1876.	1875.	Inc. or Dec.	P. c.
Earnings.....	$24,670,150 30	$23,632,761 53	Inc. $1,037,388 77	4.4
Expenses.....	17,414,507 55	15,479,679 65	Inc. 1,934,827 90	12.5
Net earnings....	$7,255,642 75	$8,153,081 88	Dec. $897,439 13	11.1
Rentals, interest, dividends, etc..	7,291,496 57	7,473,789 95	Dec. 182,293 38	2.4
Profit.....	.....	$679,291 93	Dec. $715,145 75	105.3
Loss.....	$35,853 82	.....		

Taking the lines east and west of Pittsburgh we have for the two years:

	1876.	1875.	Inc. or Dec.	P. c.
Earnings.....	$61,561,211	$58,096,866	Inc.. $3,464,345	6.0
Expenses.....	39,495,737	38,520,588	Inc.. 975,149	2.5
Net earnings.....	$22,065,474	$19,576,278	Inc.. $2,489,196	12.7
Income from securities, etc.....	3,085,132	3,344,816	Dec.. 259,684	7.8
Available income...	$25,150,606	$22,921,094	Inc.. $2,229,512	9.7

It is easy on seeing the considerable increase in income shown above to draw the conclusion that after all last year's rates were sufficient, and that it is only reasonable of the public to expect their continuance. We have, therefore, taken some pains to see how far the income of the year was affected by the exceptional traffic in passengers, which was only to a limited degree affected by the rates, but chiefly due to an exceptional cause, quite out of the power of the company. The profits of the company were evidently largely reduced by the extremely low freight rates which prevailed for two-thirds of the year, and this company has a strong interest in avoiding a contest which would have a similar effect this year. President Scott's report indicates that it recognizes this fact, and that it will endeavor to avoid such a contest.

The Decision in the Granger Cases.

The long-expected decision of the cases before the United States Supreme Court as to the validity of the Iowa and Wisconsin laws limiting railroad tariffs, and the Illinois law limiting elevator charges, was rendered last week, and is published in this paper nearly in full. The Court affirms fully the authority of the Legislature to regulate such charges, basing its decision solely on the ground that "when private property is affected with a public interest it is not *juris privatis* only. * * Property does become clothed with a public interest when used in a manner to make it of public consequence and affect the community at large. When, therefore, one devotes his property to a use in which the public has an interest, he in effect grants to the public an interest in that use, and must submit to be controlled by the public for the common good, to the extent of the interest he has thus created." This is very broad ground, and once adopted it only remained for the Court to decide whether the railroads and warehouses in question were 'things of public interest and use,' which there could be little difficulty in determining, at least in the case of the railroads. And in answer to the plea that the owners of such a property are entitled to a reasonable compensation, and that what is reasonable is a judicial and not a legislative question, the Court replies that the practice has been otherwise, and the custom has been for the Legislature to declare what shall be a reasonable compensation under such circumstances, or to fix a maximum beyond which any charge made would be unreasonable. The Court adds: "We know that this is a power which may be abused, but that is no argument against its existence. For protection against abuses by legislatures the people must resort to the polls, not to the courts."

In none of the cases decided by the Court, we believe, was the point involved of the violation of the contracts between the States and the railroad companies contained in charters which expressly grant to the companies the right of fixing charges—a right given by most of the Illinois charters. But the affirmation of the power of the Legislature to regulate rates is general, and will apply certainly to most railroads in the country. It has been declared the law, only one judge dissenting from the decision, and it is the law under which the railroads will have to exist as best they may. That the legislative power thus affirmed is liable to great abuses, needs no explanation; that it has been abused while contested, the history of recent Northwestern legislation and of Northwestern railroads gives proof; that it is much more liable to abuse in this country, and especially in the West, than most legislative power, we have heretofore endeavored to show as due to the peculiar ownership of railroad property and the total lack of a direct interest in the profitableness of railroad investments on the part of almost the whole body of voters in many States, and the great and universal interest of the same persons in cheap transportation. It is a case in which the buyers may fix the price of one of their necessities of life without even consulting the seller, while the latter cannot take his property away or refuse its use.

But the law being as it is, the railroad companies have a duty imposed upon them for their own protection which they should not dare to neglect, and that is the provision of full, clear and readily accessible information concerning the business of railroad transportation in general, and of their respective operations in particular. There is some danger that communities which own little or no railroad property will not be willing to permit a reasonable income from it; but the danger is much greater that such communities, and also others where railroad securities are largely held, will destroy the profitableness of railroads without meaning to, by ill-advised regulation of rates, laws concerning discriminations and the like. On the whole Americans, in the West as well as in the East, are willing to have capital earn an income, and do not grudge a liberal rate of interest. But there are many features in transportation business which are almost inevitable and tend to the common good, but seem at first sight, even to intelligent men experienced in business, unreasonable and unjust. Now we shall be liable to have great injury done by legislation intended to remedy supposed injustice which is no injustice, until some of the somewhat obscure

principles of transportation and tariffs become widely known in the community. A sort of general education of the public becomes necessary for the protection of railroad property. This is a tremendous task, at best a long one, and after all a never-ending one; but there certainly is grave danger in depending for justice upon an unenlightened public. So long as the question was one as to power, there was little disposition to discuss policy; but when it is known that the laws passed will certainly go into effect, there will probably be more care in framing the laws, more disposition to look forward to their effect, and more willingness to take some trouble to understand the nature of the business to which they apply, and to consult experts concerning it, and study the experience of other communities with restrictive laws. Railroad officers hereafter should count it among their duties to their employers, the proprietors of the railroads, not only to gain knowledge concerning their business and to apply it in practice, but to impart certain phases of that knowledge to the community.

Transportation Legislation in the Last Congress.

The last session of Congress is more remarkable for what it did not do than for what it did relative to transportation affairs. The various bills for settling the payments to be made by the Pacific railroads to the Government for the purpose of canceling the great debt which will be due by the former near the close of this century were discussed at considerable length in the Senate, but were finally postponed until December. One of these bills was acceptable to the companies; another, that of the Judiciary Committee, quite the reverse. This latter certainly changed materially the terms of the existing contract between the companies and the Government, and would seem at first sight clearly unconstitutional; but it is notable that it was supported by the best lawyers in the Senate, such as Judges Thurman, Christiancy and McMillan, they holding, we believe, that the authority "to alter and amend" reserved to Congress in the existing acts is sufficient to warrant the proposed legislation.

The bill to lend Government credit to the Texas & Pacific Railway failed to come to a vote, as did that to extend the time for the completion of the Northern Pacific. We believe that the promoters of the former did not feel sure of a favorable vote. The latter perhaps would have passed without much opposition had the time of Congress not been so limited by the presidential count.

Appropriation was made by the Senate to provide for fast mails; but the House refused to concur. An appropriation of $150,000, however, was made to improve the postal-car service.

The subsidies heretofore for many years paid to the Pacific Mail Steamship Company were discontinued. The Occidental & Oriental Company offered to carry the Japan and China mails for the postage, and though the Senate voted a continuance of a subsidy of $500,000, and even voted a similar sum for a line between New Orleans and Rio Janeiro, the House would not concur.

The bill offered by Mr. Garfield for the investigation of railroad accidents by a board of engineer officers did not come to a vote—indeed, was not reported to the House by the Railroad Committee, we believe—but this failure doubtless was due to lack of time; and if it comes up at the next session it will probably pass.

The appropriation for continuing the experiments on iron and steel passed the Senate, but was thrown out by the House.

The Supreme Court Decision in the "Granger" Cases.

The Supreme Court of the United States, March 1, decided the so-called granger cases, the first one being that of Ira Y. Munn and George L. Scott, plaintiffs in error, vs. The People of the State of Illinois, in error to the Supreme Court of the State of Illinois.

Mr. Justice Waite delivered the opinion of the Court, Judge Field alone dissenting:

The question to be determined in this case is whether the General Assembly of Illinois can, under the limitations upon the legislative power of the States imposed by the constitution of the United States, fix by law the maximum of charges for the storage of grain in warehouses in Chicago and other places in the State having not less than 100,000 inhabitants, in which grain is stored in bulk, and in which the grain of different owners is mixed together, or in which grain is stored in such a manner that the identity of the different lots or parcels cannot be accurately preserved. It is claimed that such a law is repugnant—

First—To that part of section eight, article one, of the constitution of the United States which confers upon Congress the power "to regulate commerce with foreign nations and among the several States."

Second—To that part of section nine of the same article, which provides that "no preference shall be given by any regulation of commerce or revenue to the ports of one State over those of another."

Third—To that part of the fourteenth amendment which ordains that no State shall "deprive any person of life, liberty or property without due process of law; nor deny to any person within its jurisdiction the equal protection of the laws."

We will consider the last of these objections first. Every statute is presumed to be constitutional. The courts ought not to declare one to be unconstitutional unless it is clearly so. If there is doubt the expressed will of the Legislature should be sustained. The constitution contains no definition of the word "deprive" as used in the fourteenth amendment.

To determine its signification, therefore, it is necessary to ascertain the effect which usage has given it when employed in the same or a like connection. While this provision of the amendment is new in the constitution of the United States as a limitation upon the powers of the States, it is old as a principle of civilized government. It is found in Magna Charta and, in substance, if not in form, in nearly or quite all the constitutions that have been from time to time adopted by the several States of the Union. By the fifth amendment it was introduced into the constitution of the United States as a limitation upon the powers of the national government, and by the fourteenth as a guaranty against any encroachment upon an acknowledged right of citizenship by the legislatures of the States. When the people of the United Colonies separated from Great Britain, they changed the form but not the substance of their government. They retained for the purposes of government all the powers of the British Parliament, and through their State constitutions or other forms of social compact, undertook to give practical effect to such as they deemed necessary for the common good and the security of life and property. All the powers which they retained they committed to their respective States, unless in express terms or by implication reserved to themselves. Subsequently, when it was found necessary to establish a national government for national purposes, a part of the powers of the States and of the peoples of the States was granted to the United States and the people of the United States. This grant operated as a further limitation upon the powers of the States, so that now the governments of the States possess all the powers of the Parliament of England, except such as have been delegated to the United States or reserved by the people. The reservations by the people are shown in the prohibitions of the constitutions. When one becomes a member of a society he necessarily parts with some rights or privileges which, as an individual, not affected by his relations to others, he might retain.

"A body politic," as aptly defined in the preamble of the constitution of Massachusetts, is a social compact, by which the whole people covenants with each citizen and each citizen with the whole people that all shall be governed by certain laws for the common good. This does not confer power upon the whole people to control rights which are purely and exclusively private (Thorpe vs. the R. & B. Railroad Company, 27 Vt., 143), but it does authorize the establishment of laws requiring each citizen to so conduct himself and so use his own property as not unnecessarily to injure another. This is the very essence of government and has found expression in the maxim, *sic utere tuo ut alienum non laedas*. From this source came the police powers, which, as was said by Chief Justice Taney in the license cases (5 How., 583), "are nothing more nor less than the powers of government inherent in every sovereignty. * * * That is to say * * * the power to govern men and things. Under these powers the government regulates the conduct of its citizens, one toward another, and the manner in which each shall use his own property when such regulation becomes necessary for the public good. In their exercise it has been customary in England from time immemorial, and in this country from its first colonization, to regulate ferries, common carriers, hackmen, bakers, millers, wharfingers, innkeepers, etc., and in so doing to fix a maximum of charge to be made for services rendered, accommodations furnished and articles sold. To this day statutes are to be found in many of the States upon some or all of these subjects, and we think it has never yet been successfully contended that such legislation came within any of the constitutional prohibitions against interference with private property. With the fifth amendment in force Congress in 1870 conferred power upon the city of Washington to regulate * * the rates of wharfage at private wharves * * the sweeping of chimneys and to fix the rates of fees therefor, * * * and the weight and quality of bread (3 Statutes, 587, section 7); and in 1848, to make all necessary regulations respecting hackney carriages and the rates of fare of the same, and the rates of hauling by cartmen, wagoners, carmen and draymen, and the rates of commission of auctioneers" (9 Statutes, 224, section 2). From this it is apparent that down to the time of the adoption of the fourteenth amendment it was not supposed that the statutes regulating the use or even the price of the use of private property necessarily deprived an owner of his property without due process of law. Under some circumstances they may, but not under all. The amendment does not change the law in this particular. It simply prevents the States from doing that which will operate as such a deprivation.

This brings us up to inquire as to the principles upon which this power of regulation rests, in order that we may determine what is within and what without its operative effect. Looking, then, to common law, from whence come the rights which the constitution protects? We find that when private property is affected with a public interest it ceases to be *juris privati* only. This was said by Lord Chief Justice Hale more than 200 years ago in his treatise, "*De Portibus Maris*," (and has been accepted without objection as an essential element in the law of property ever since. Property does become clothed with a public interest when used in a manner to make it of public consequence and affect the community at large. When, therefore, one devotes his property to a use in which the public has an interest, he in effect grants to the public an interest in that use, and must submit to be controlled by the public for the common good to the extent of the interest he has thus created. He may withdraw his grant by discontinuing the use, but so long as he maintains the use he must submit to the control.

After quoting Lord Hale as to ferries, wharves and wharfingers, and the decision of the Supreme Court of Alabama, because the Court thought they found in them the principle which supports the legislation they were examining, the opinion continues as follows:

Enough has already been said to show that when private property is devoted to a public use it is subject to public regulation. It remains only to ascertain whether the warehouses of these plaintiffs in error and the business which is carried on there come within the operation of this principle. For this purpose we accept as true the statements of fact contained in the elaborate brief of one of the counsel of the plaintiffs in error.

From these it appears that the great producing region of the West and Northwest sends its grain by water and rail to Chicago, where the greater part of it is shipped by vessel for transportation to the seaboard by the great lakes, and some of it is forwarded by railway to the Eastern ports. * * * Vessels to some extent are loaded in the Chicago harbor and sailed through the St. Lawrence directly to Europe. * * * The quantity (of grain) received in Chicago has made it the greatest grain market in the world. This business has created a demand for means by which the immense quantity of grain can be handled or stored, and these have been found in grain warehouses which are commonly called elevators because the grain is elevated from the boat or car by machinery, operated by steam, into the bins prepared for its reception, and elevated from the bins by a like process into the vessel or car which is to carry it on. * * * In this way the largest traffic between the citizens of the country north and west of Chicago and the citizens of the country lying on the Atlantic coast north of Washington is in grain which passes through the elevators of Chicago. In this way the trade in grain is carried on by the inhabitants of seven or eight of the great States of the West with four or five of the States lying on the seashore, and forms the largest part of inter-state commerce in these States. The grain elevators or warehouses in Chicago are immense structures, holding from 300,000 to 1,000,000 bushels at one time, according to size. They are divided into bins of large capacity and great strength. * * * They are located with the river harbor on one side and the railway track on the other, and the grain is run through them from car to vessel or boat to car, as may be demanded in the course of business. It has been found impossible to preserve the owners' grain separate, and thus has given rise to a system of inspection and grading by which the grain of different owners is mixed and receipts issued for the number of bushels which are negotiable and redeemable in like kind upon demand. This mode of conducting the business was inaugurated more than twenty years ago, and has grown to immense proportions. The railroads have found it impracticable to own such elevators, and public policy forbids the transaction of such business by the carrier. The ownership has, therefore, been by private individuals, who have embarked their capital and devoted their industry to such business as a private pursuit. In this connection it must also be borne in mind that, although in 1874 there were in Chicago fourteen warehouses adapted to this particular business and owned by about thirty persons, nine business firms controlled them, and that the prices charged and received for storage were such as have been from year to year agreed upon and established by the different elevators or warehouses in the city of Chicago, and which rates have been annually published in one or more newspapers printed in said city in the month of January in each year, as the established rates for the year then next ensuing such publication. Thus it is apparent that all the elevating facilities through which these vast productions of seven or eight great States of the West must pass on the way to four or five of the States on the seashore may be a virtual monopoly. Under such circumstances it is difficult to see why, if the common carrier or the miller or the ferryman or the inn-keeper or the wharfinger or the hackney coachman pursues a public employment and exercises a sort of public office, these plaintiffs in error do not. They stand, to use again the language of their counsel, in the very "gateway of commerce," and take toll from all who pass. Their business most certainly "tends to a common charge and is become a thing of public interest and use." Every bushel of grain for its passage "pays a toll, which is a common charge;" and, therefore, according to Lord Hale, every such warehouseman ought to be under public regulation, viz., that he take but reasonable toll. Certainly, if any business can be clothed with a public interest and cease to be *juris privati* only this has been. It may not be made so by the operation of the constitution of Illinois or this statute, but it is by the facts.

We also are not permitted to overlook the fact that, for some reason, the people of Illinois, when they revised their constitution in 1870, saw fit to make it the duty of the General Assembly to pass laws "for the protection of producers, shippers and receivers of grain and produce" (article 13, section 7), and by section 5 of the same article to require all railroad companies receiving and transporting grain, in bulk or otherwise, to deliver the same at any elevator to which it might be consigned that could be reached by any track that was or could be used by such company; and that all railroad companies should permit connections to be made with their tracks, so that any public warehouse, etc., might be reached by the cars on their railroads. This indicates very clearly that during the twenty years in which this peculiar business has been assuming its present "immense proportions" something had occurred which led the whole body of the people to suppose that remedies such as are usually employed to prevent abuses by virtual monopolies might not be inappropriate here. For our purposes we must assume that if a state of facts could exist that would justify such legislation, it actually did exist when the statute now under consideration was passed. For us the question is one of power, not of expediency. If no state of circumstances could exist to justify such a statute then we may declare this one void, because in excess of the legislative power of the State; but if it could, we must presume it did. Of the propriety of legislative interference within the scope of legislative power the Legislature is the exclusive judge. Neither is it a matter of any moment that no precedent can be found for a statute precisely like this. It is conceded that the business is one of recent origin, that its growth has been rapid, and that it is already of great importance. And it must also be conceded that it is a business in which the whole public has a direct and positive interest. It presents, therefore, a case for the application of a long known and well established principle in social science, and this statute simply extends the law so as to meet this new development of commercial progress. There is no attempt to compel these owners to grant the public an interest in their property, but to declare their obligations if they use it in this particular manner. It matters not in this case that the plaintiffs in error had built their warehouses and established their business before the regulations complained of were adopted. What they did was from the beginning subject to the power of the body politic to require them to conform to such regulations as might be established by the proper authorities for the common good. They entered upon their business and provided themselves with the means to carry it on subject to this condition. If they did not wish to submit themselves to such interference they should not have clothed the public with an interest in their concerns. The same principle applies to them that does to the proprietor of a hackney carriage and as to him it has never been supposed that he was exempt from regulating statutes or ordinances because he had purchased his horses and carriage and established his business before the statute or the ordinance was adopted.

It is insisted, however, that the owner of the property is entitled to a reasonable compensation for its use, even though it be clothed with a public interest, and that what is reasonable is a judicial and not a legislative question. As has already been shown, the practice has been otherwise. In countries where the common law prevails it has been customary from time immemorial for the legislature to declare what shall be a reasonable compensation under such circumstances; or, perhaps more properly speaking, to fix a maximum beyond which any charge made would be unreasonable. Undoubtedly in mere private contracts relating to matters in which the public has no interest, what is reasonable must be ascertained judicially. But this is because the Legislature has no control over such a contract. So, too, in matters which do affect the public interest, and as to which legislative control may be exercised, if there are no statutory regulations upon the subject the courts must determine what is reasonable. The controlling fact is the power to regulate at all. If that exists, the right to establish the maximum of charge as one of the means of regulation is implied. In fact, the common law rule which requires the charge to be reasonable is itself a regulation as to price. Without it the owner could make his rates at will and compel the public to yield to his terms or forego the use. But a mere common law regulation of trade or business may be changed by statute. A person has no property, no vested interest in any rule of the common law. That is only one of the forms of municipal law, and is no more sacred than any other. Rights of property which have been created by the common law cannot be taken away without due process; but the law itself, as a rule of conduct, may be changed at the will, or even at the whim, of the Legislature, unless prevented by constitutional limitations. Indeed, the great office of statutes is to remedy defects in the common law as they are developed, and to adapt it to the changes of time and circumstances. To limit the rate of charge for services rendered in a public employment, or for the use of property in which the public has an interest, is only changing a regulation which existed before. It establishes no new principle in the law, but only gives a new effect to an old one. We know that this is a power which may be abused, but that is no argument against its existence. For protection against abuses by legislatures the people must resort to the polls, not to the courts. After what has already been said it is unnecessary to refer at length to the effect of the other provision of the fourteenth amendment, which is relied upon—viz., that no State shall "deny to any person within its jurisdiction the equal protection of the laws." Certainly it cannot be claimed that this prevents the State from regulating the fares of hackmen or the charges of draymen in Chicago, unless it does the same thing in every other place within its jurisdiction. But, as has been seen, the power to regulate the business of warehouses depends upon the same principle as the power to regulate hack-

men and draymen, and what cannot be done in one case in this particular cannot be done in the other.

We come now to consider the effect upon this statute of the power of Congress to regulate commerce. It was very properly said in the case of the State tax on railway gross receipts (15 Wall. 293) that "It is not everything that affects commerce that amounts to a regulation of it within the meaning of the constitution." The warehouses of these plaintiffs in error are situated and their business carried on exclusively within the limits of the State of Illinois. They are used as instruments by those engaged in State as well as those engaged in inter-State commerce, but they are no more necessarily a part of commerce itself than the dray or the cart by which, but for them, grain would be transferred from one railroad station to another. Incidentally they may become connected with an inter-State commerce, but not necessarily so. Their regulation is a thing of domestic concern, and certainly until Congress acts in reference to their inter-State relations the State may exercise all the powers of government over them, even though in so doing it may indirectly operate upon commerce outside its immediate jurisdiction. We do not say that a case may not arise in which it will be found that a State, under the form of regulating its own affairs, has encroached upon the exclusive domain of Congress in respect to inter-State commerce, but we do say that upon the facts as they are represented to us in this record that has not been done.

The remaining objection—to wit, that the statute in its present form is repugnant to section 9, article 1, of the constitution of the United States, because it gives preference to the ports of one State over those of another—may be disposed of by the single remark that this provision operates only as a limitation of the powers of Congress, and in no respect affects the States in the regulation of their domestic affairs. We conclude, therefore, that the statute in question is not repugnant to the constitution of the United States and that there is no error in the judgment.

In passing upon this case we have not been unmindful of the vast importance of the questions involved. This and cases of a kindred character were argued before us more than a year ago by the most eminent counsel and in a manner worthy of their well earned reputations. We have kept the case long under advisement in order that the decision might be the result of our mature deliberations.

The judgment is affirmed.

THE RAILROAD CASES.

The Supreme Court the same day, among others, also rendered the following decisions:

No. 27—*Pick et al. vs. Chicago & Northwestern Railway Company et al.*, and No. 40—*Lawrence et al. vs. Paul et al. and The Chicago & Northwestern Railway Company.*—Appeals from the Circuit Court for the Western District of Wisconsin.—These suits present the single question of the power of the Legislature of the State of Wisconsin to provide by law for a maximum of charge to be made by the Chicago & Northwestern Railroad Company, for fare and freight upon the transportation of persons and property carried within the State, or taken up outside and brought within it, or taken up inside and carried out. The decision is that until Congress acts in reference to the relations of the inter-State commerce, it is competent for the State to regulate the fares of the railroads so far as they are of domestic concern. This company, it is said, has domestic relations with the State, and incidentally these relations may reach beyond the State. Until Congress undertakes to legislate for those who are without the State, Wisconsin may provide for those within, even though it may indirectly affect those without. Affirmed. The Chief Justice delivered the opinion.

No. 324—*The Chicago, Burlington & Quincy Railroad Company vs. The Attorney General and State Treasurer of Iowa.*—An appeal from the Iowa Circuit.—In this case it is said railroad companies are carriers for hire. They are incorporated powers in order that they may the better serve the public in that capacity. They are, therefore, engaged in a public employment, affecting the public interests, and under the decision in Munn and Scott, vs. the People of Illinois (the principal case) subject to Legislative control as to their rates of fare and freight unless protected by their charters. In the absence of legislative regulation on the subject of fares the courts must decide for it, as they do for private persons when controversies arise, what is reasonable. But when the Legislature steps in and prescribes a maximum of charge, it operates upon this corporation the same as it does upon individuals engaged in a similar business. A uniform rate of charges for all railroad companies in the State might operate unjustly upon some. It was proper, therefore, to provide in some way for adaptation of the rates to the circumstances of the different roads, and the Legislature in the exercise of its distinction, has seen fit to do this by a system of classification, and whether this was the best that could be done is not for the court to decide. Affirmed.

The Chief Justice delivered the opinion.

No. 352—*The Chicago, Milwaukee & St. Paul Railroad Company vs. Ackley et al.*—Error to the Circuit Court for Wisconsin.—The only question presented in this case is whether a railroad company in Wisconsin can recover for the transportation of property more than the maximum fixed by the statute by showing that the amount charged was no more than a reasonable compensation for the services rendered. The decision is that as between the company and a freighter, the maximum of the statute is the limit of the recovery for transportation actually performed. If the company should refuse to carry at the prices fixed, and an attempt should be made to forfeit its charter on that account, other questions might arise which will not be anticipated at this time. For goods actually carried, the limit of the statute is the limit of the recovery. Affirmed.

The Chief Justice delivered the opinion.

No. 353—*Stowe vs. State of Wisconsin.*—Error to the Circuit Court for Wisconsin. The only question in this case, not decided in the case of the Chicago, Milwaukee & St. Paul Railroad Company against Ackley, just decided, is as to the effect upon the rights of these parties of the charter of the Milwaukee & Waukesha Railroad Company, passed by the Territorial Legislature of Wisconsin in 1847. This provides that on the completion of said railroad, or any portion of the track not less than 10 miles, it shall be lawful for the company to demand and receive such sum or sums of money for passage and freight of persons and property as they shall, from time to time, think reasonable. This, it was claimed, gave the company charter right to fix its own rates of fare and freight, subject only to a judicial determination as to whether they are reasonable. The court affirms the view of the Supreme Court of the State on this subject, that the charter was accepted and the corporation organized many months after the adoption of the Constitution and the admission of the State into the Union by Congress. Previous to that time it remained a naked proposition. For this reason it is held that its acceptance, after the organization of the State, so far as it is a contract, makes it manifestly a contract with the State. Affirmed.

The Chief Justice delivered the opinion.

No. 10—*The Winona & St. Peter Railroad Company vs. Blake et al.*—Error to the Supreme Court of Minnesota, and No. 74—*McGrath, Receiver, vs. Coleman.*—Error to the Circuit Court for the District of Minnesota. In the former case it is said that the road was by its charter bound to carry when called upon—as a common carrier—and charge only reasonable rates. These are incidents of the occupation in which it was authorized to engage. The case is held to fall within the decision in No. 90, decided at the same time, and stated above. In No. 74 it is held the question is the same, and the decision is affirmed in both cases. The Chief Justice delivered the opinion.

Mr. Justice Field dissented in all the Granger cases, and with permission of the court will hereafter file an opinion.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

Chicago & Northwestern.—Messrs. Sidney Dillon, Jay Gould and Oliver Ames, all directors of the Union Pacific, have been chosen directors of this company in place of Charles R. Marvin, John F. Tracy and Francis H. Tows, resigned.

Chicago, Rock Island & Pacific.—Messrs. Sidney Dillon, Jay Gould and Oliver Ames have been chosen directors in place of Messrs. P. L. Cable, George L. Davenport and Milton Courtright. The new directors are all members of the Union Pacific board.

Lawrence.—At the annual meeting in Pittsburgh recently Thomas D. Messler was chosen President, with the following directors: G. W. Cass, John B. Jackson, J. N. McCullough, A. L. Crawford, R. W. Cunningham, W. A. Parmalee. The board elected F. M. Hutchinson Secretary and Treasurer. The road is worked by the Pennsylvania Company.

Central, of New Jersey.—Gen. Fitz John Porter has been appointed Assistant to the Receiver.

Louisville, New Albany & St. Louis.—The bondholders, who bought this road at foreclosure sale, have organized by electing the following directors: J. J. Brown, E. Newland, New Albany, Ind.; Samuel Bayard, Evansville, Ind.; St. John Boyle, C. N. Warren, Louisville, Ky.; E. Cummings, Covington, Ky.; Philo C. Calhoun, New York. The board elected officers as follows: President, Dr. E. Newland; Vice-President, St. John Boyle; Secretary and Treasurer, George Lyman. The office is at New Albany, Ind.

Ohio & Mississippi.—The United States Circuit Court has removed Messrs. John King, Jr., and Daniel Torrance, Receivers of this road, and has appointed Mr. John King, Jr., sole Receiver.

Vaca Valley & Clear Lake.—The first board of directors consists of J. Donaldson, T. Mansfield, A. M. Stevenson, G. B. Stevenson and A. Theodore. The office is in Vacaville, Cal.

Keokuk, Galesburg & Chicago.—At the annual meeting in Galesburg, Ill., recently, the following directors were chosen: George W. Brown, C. H. Mathews, A. C. Clay, W. Selden Gale, O. T. Johnson, S. H. Ferris, B. Lombard, Jr., Clark E. Carr, B. F. Arnold, W. W. Washburn, J. C. Stewart, D. H. Frisbie. The board elected C. H. Mathews, President; O. T. Johnson, Treasurer; W. W. Washburn, Secretary.

Baltimore & Potomac.—Mr. Alexander W. Nutt is appointed General Freight Agent, with office in Baltimore.

Walla Walla & Columbia River.—The officers are: D. S. Baker, President; J. F. Boyer, Vice-President; Wm. Stephens, Treasurer; E. F. Baker, Agent. The offices are at Walla Walla, Washington Territory.

Portland & Rochester.—Receiver Westcott has appointed Wm. H. Conant, Portland, Me., Cashier, and has continued J. M. Lunt as Superintendent and J. W. Peters as General Ticket Agent.

Northern Central.—Mr. Alexander W. Nutt is appointed General Freight Agent, with office in Baltimore.

Marietta, Pittsburgh & Cleveland.—At the annual meeting in Marietta, O., Feb. 13, the following directors were chosen: A. J. Warner, Isaac Morton, G. W. Davies, Samuel Shipman, Thomas W. Ewart, Wm. P. Richardson, C. W. West.

Illinois Midland.—Mr. M. C. Tully has been appointed Auditor, with office at Paris, Ill.

Pittsburgh & Castle Shannon.—At the annual meeting in Pittsburgh, Feb. 20, M. D. Hays was chosen President, with the following directors: James Kerr, Josiah Reamer, F. T. Plunkett, D. O. Cunningham, Thomas N. Miller, John Jahn, H. M. Rolfe, J. H. Ortman, James M. Bailey, James McQuiston.

Housatonic.—At the annual meeting in Bridgeport, Conn., Feb. 23, the old board was re-elected as follows: David S. Draper, Great Barrington, Mass.; Wm. H. Barnum, Lime Rock, Conn.; George W. Peet, Falls Village, Conn.; A. B. Mygatt, New Milford, Conn.; W. D. Bishop, Horace Nichols, Bridgeport, Conn.; Edward Leavitt, Charles A. Peck, Samuel Willetts, New York. The board re-elected Wm. H. Barnum President; David S. Draper, Vice-President; Charles K. Averill, Secretary and Treasurer.

Cincinnati & Baltimore.—At the annual meeting in Cincinnati, Feb. 21, the following directors were chosen: Kenner Garrard, W. W. Scarborough, Cincinnati; W. T. McClintick, Wm. Waddle, Chillicothe, O.; Robert Garrett, John King, Jr., John Donnell Smith, Baltimore. The board elected Wm. T. McClintick, President; Charles F. Low, Secretary, Wm. E. Jones, Treasurer. The road is leased to the Marietta & Cincinnati.

Missouri Pacific.—At the annual meeting in St. Louis, March 6, the following directors were chosen: D. R. Garrison, Oliver Garrison, D. K. Ferguson, W. M. Samuels, St. Louis; Joseph W. Stephens, Boonville, Mo.; A. M. Billings, Chicago; George C. Forrest, C. K. Garrison, W. R. Garrison, J. P. Kennedy, D. R. Mangum, Russell Sage, A. V. Stout, New York. The only change is the substitution of George C. Forrest for Mortimer Ward, of New York.

Union Depot, of St. Louis.—At the annual meeting in St. Louis, March 6, the following directors were chosen: R. H. Shoemaker, W. D. Griswold, Samuel Gaty, Wm. Taussig, St. Louis; W. H. Clements, J. N. Kinney, Cincinnati. The board elected W. H. Clements President; R. H. Shoemaker, Vice-President.

St. Louis, Kansas City & Northern.—At the annual meeting in St. Louis, March 6, the following directors were chosen: B. W. Lewis, Jr., John Jackson, James H. Britton, George D. Hall, L. B. Parsons, John A. Scudder, Joseph Bogy, W. Spear, James F. How, St. Louis; Solon Humphreys, Joseph A. Jameson, New York. The new directors are W. Spear and Solon Humphreys, who replace Robert E. Carr and John T. Terry. Mr. Humphreys was a director up to the election of last year.

Stillwater & St. Paul.—At the annual meeting in Stillwater, Minn., Feb. 27, the following directors were chosen: David Bronson, John McKusick, H. R. Murdock, Stillwater, Minn.; James Smith, Jr., St. Paul, Minn.; S. M. Felton, W. G. Moorhead, G. F. Tyler, Philadelphia. The board elected D. Bronson President; S. M. Felton, Vice-President; H. R. Murdock, Secretary; T. M. Davis, Treasurer. The road is worked by the Lake Superior & Mississippi.

Atlantic & Gulf.—The United States Circuit Court has appointed Col. John Screven (President of the company) and Samuel A. Strang Receivers. They have appointed Col. H. S. Haines, General Superintendent, their Agent and Manager of the property.

Detroit & Bay City.—Mr. John Twigg has been appointed Master Mechanic, with office at Grand Trunk Junction, near Detroit.

Southern Minnesota.—The purchasing bondholders have organized a new company under the same name, with the following officers: President, C. B. Gold, New York; Vice-President and Secretary, Peter M. Meyers, New York; Treasurer, Wm. C. Van Horne, La Crosse, Wis.

PERSONAL.

—It is reported that Mr. George Bachelder is to retire from the position of Superintendent of the Eastern Railroad shortly.

—Mr. D. M. Boyd, Jr., General Passenger Agent of the Pennsylvania Railroad, has been dangerously sick, but has so far recovered that he was to start on a trip to Florida this week.

—Hon. Daniel S. Biser, a well-known lawyer and politician, and the oldest director of the Chesapeake & Ohio Canal Company, died at his residence in Burkettsville, Frederick County, Md., Feb. 27, aged 76 years.

—Mr. Otis T. Ruggles, for many years Superintendent of the Vermont & Massachusetts Railroad, died at his residence in Fitchburg, Mass., March 3.

—Mr. D. C. Branham, of Madison, Ind., one of the Receivers of the Cincinnati, Rockport & Southwestern road, died last week after a short illness.

—Mr. W. W. Thompson, Paymaster of the Louisville & Nashville Railroad, was recently presented with a very fine gold watch, valued at $500, by friends connected with the road.

—Mr. John Q. Hoyt, Vice-President and one of the leading projectors of the New York, Boston & Montreal Company, has been adjudged a bankrupt on his own petition. His liabilities, chiefly for money borrowed, are stated at $1,625,000, and the nominal value of the assets at $458,000, the latter consisting principally of railroad bonds and real estate on the line of the road. The Central Vermont Company, of which Mr. Hoyt was at one time a director, appears as a creditor to the amount of $22,000.

TRAFFIC AND EARNINGS.

Railroad Earnings.

The following are reports made to the California Transportation Commission for the year ending Dec. 31, 1876:

	Earnings.	Expenses.	Net earnings.	Earn. pr. mile.	P. c. of exps.
California Pacific..	$1,296,522	$1,066,872	$229,650	$11,475	82.29
Sacramento Valley	162,663	127,266	35,397	3,320	78.22
Stockton & Visalia.	49,167	63,790	*14,623	1,003	120.65
Southern Pacific...	2,806,737	1,396,520	1,410,217	.....	49.76

*Deficit.

Other earnings for various periods are reported as follows:

Year ending Dec. 31:	1876.	1875.	Inc. or Dec.		P. c.
Midland, of Canada..	$272,955	$284,323	Dec..	$11,368	4.0
Expenses.....	173,335	179,222	Dec..	5,887	3.3
Net earnings.....	$99,620	$105,101	Dec..	$5,481	5.2
Earnings per mile.	2,100	2,585	Dec..	485	18.8
Per cent. of exps..	63.50	63.03	Inc ..	0.47	0.7
Month of January:	1877.	1876.			
Mobile & Ohio.....	$232,382	$234,131	Dec..	$1,749	0.7
St Joseph & Denver City.....	28,280	26,823	Inc ..	1,457	5.4
St. Louis & Southeastern	91,257	80,842	Inc ..	10,415	12.9
Expenses.....	66,469	69,431	Dec..	2,962	4.3
Net earnings.....	$24,788	$11,411	Inc ..	$13 377	117.3
Per cent. of exps..	72.80	85.89	Dec..	13.09	15.2
Month of February:					
International & Great Northern	$138,000	$118,000	Inc ..	$20,000	16.9
Missouri, Kansas & Texas.....	255,309	254,723	Dec..	19,414	7.6
Third week in February:					
Atchison, Topeka & Santa Fe.....	$39,943	$43,307	Dec..	$3,364	7.8
Denver & Rio Grande	10,600	.....	.....	.....	....
St. Louis, Iron Mt. & Southern.....	105,600	94,565	Inc ..	11,035	11.7
Week ending Feb. 23:					
Great Western, of Canada.....	$76,814	$74,298	Inc ..	$2,516	3.4
Week ending Feb. 24:					
Grand Trunk.....	$164,796	$188,801	Dec..	$24,005	12.7

Coal Movement.

Tonnages for the week ending Feb. 24, are reported as follows:

	1877.	1876.	Inc. or Dec.	P. c.
Anthracite.....	276,383	44,236	Inc .. 232,147	524.8
Semi-bituminous	33,256	33,900	Dec.. 644	1.9
Bituminous, Pennsylvania	35,863	30,541	Inc .. 5,322	17.4

Production in the Cumberland region is almost suspended, owing to the labor and transportation troubles there. In the corresponding week in 1876 anthracite production was partially suspended.

Chicago coal receipts for last year were:

	1876.	1875.	Inc. or Dec.	P. c.
Chicago & Alton.....	293,807	278,006	Inc .. 15,801	5.7
Chicago, Danville & Vincennes.....	196,865	205,530	Dec.. 8,665	4.2
Pittsburgh, Fort Wayne & Chicago	142,697	112,609	Inc .. 30,088	26.7
Pittsburgh, Cincinnati & St. Louis.....	106,774	150,349	Dec.. 43,575	29.0
Lake Shore & Michigan Southern.....	55,205	778	Inc .. 54,427	....
Other railroads.....	106,827	142,732	Dec.. 35,905	26.2
Canal.....	5,292	7,778	Dec.. 2,486	32.6
Lake	711,572	748,706	Dec.. 37,134	5.0
Total	1,619.039	1,646,488	Dec.. 27,449	1.7

The lake receipts were 44 per cent. of the whole, all or nearly all the anthracite coming to Chicago by that route.

St. Louis coal receipts for 1876 were as follows:

	1876.	1875.	Inc. or Dec.	P. c.
St. Louis, Alton & Terre Haute, Belleville.....	332,205	350,756	Dec.. 18,551	5.3
Vandalia Line.....	232,738	191,013	Inc .. 41,725	21.8
Illinois & St. Louis.....	209,699	204,625	Inc .. 5,074	2.5
St. Louis & Southeastern..	173,916	178,283	Dec.. 4,367	2.4
Ohio & Mississippi.....	140,473	160,627	Dec.. 20,154	12.5
Cairo & St. Louis.....	86,714	107,165	Dec.. 20,451	19.1
Other railroads.....	41,232	33,761	Inc .. 7,471	22.1
River and local.....	65,952	95,010	Dec.. 29,058	30.6
Total	1,282,929	1,321,240	Dec.. 38,311	2.9

The great bulk of the receipts were from Southern Illinois.

Norfolk Cotton Traffic.

Cotton receipts at Norfolk, Va., for February and for the six months of the crop year ending Feb. 28 were as follows:

	—February.—		—Six months.—	
	1877.	1876.	1876-77.	1875-76.
Atlantic, Miss. & Ohio, bales...	27,719	20,181	188,524	159,472
Seaboard & Roanoke.....	16,798	11,525	238,323	195,389
Canal and otherwise.....	3,232	3,760	38,102	35,627
Totals.....	47,749	35,466	464,949	390,488

The increase for February was 34.6 per cent.; for the six months, 19.1 per cent. Of this year's receipts in February 16,390 bales and for the six months 147,564 bales were consigned to Norfolk, the rest to points beyond.

Petroleum Movement.

Stowell's *Petroleum Reporter* gives the total production of

the Pensylvania oil districts for January at 796,390 barrels; shipments, 743,461 barrels; stock on hand at close of month, 2,604,128 barrels.

Pittsburgh shipments of refined oil for January were 97,404 barrels, 59,274 east by Pennsylvania Railroad; 37,515 east by Baltimore & Ohio, and 612 barrels west.

Grain Movement.

Baltimore grain receipts for February were:

	1877.	1876.	Inc. or Dec.	P. c.
Flour, barrels	102,957	95,721	Inc.. 7,236	7.6
Wheat, bushels	116,849	93,856	Inc.. 22,993	24.5
Corn	2,299,040	2,719,138	Dec..420,098	15.4
Other grain	46,075	67,599	Dec.. 21,524	31.8
Total, bushels	2,976,749	3,359,198	Dec..382,449	11.4

For the two months ending Feb. 28 the receipts were:

	1877.	1876.	Decrease.	P. c.
Flour, barrels	191,199	195,776	4,577	2.3
Grain, bushels	4,711,193	5,501,697	790,504	14.4
Total, bushels	5,667,188	6,480,577	813 389	12.6

Exports of flour were 37,938 barrels in February and 59,636 barrels for the two months.

Chicago receipts and shipments for the nine weeks from Jan. 1 to March 3:

	1877.	1876.	Decrease.	P. c.
Receipts	7,907,982	8,500,697	592.715	7.0
Shipments	4,228,300	4,889,992	661,692	13.5

THE SCRAP HEAP.

Railroad Manufactures.

The Baldwin Locomotive Works, at Philadelphia, have just finished four locomotives, "American" pattern, 17 by 24 in. cylinders and 5 ft. driving wheels, for the St. Louis, Kansas City & Northern road. They have in hand two consolidation engines for the Pennsylvania Railroad and some 3½ ft. gauge, anthracite burning engines for the Philadelphia & Atlantic City road.

The Cumberland Valley Railroad has recently purchased 2,000 tons of steel rails, 56 lbs. per yard, from the Cambria Iron Co., at Johnstown, Pa., for less than $48 per ton, delivered at Harrisburg.

The Lochiel Iron Works, at Harrisburg, Pa., are rolling a small lot of iron rails for the Union Railroad in Baltimore.

The plan submitted by the Keystone Bridge Co. for the proposed bridge to carry the tracks of the New York, New Haven & Hartford Railroad over Bridge street in Springfield, Mass., has been adopted and the contract for furnishing the ironwork awarded to the Keystone Co. The company has also about completed a pivot bridge 186 feet long for the Old Colony Railroad at Somerset, Mass.

The Midvale Steel Works, at Philadelphia, were running in January and February to their full capacity on tires, axles and forgings. They have orders enough on their books to ensure steady running for some months.

The Phœnixville Bridge Works of Clark, Reeves & Co. have closed contracts for the whole of the iron bridges on the Quebec, Montreal, Ottawa & Occidental Railway in Canada, over 6,000 lineal feet and between three and four thousand tons. They have also just been awarded the contract for the Cincinnati Southern bridge over the Tennessee River near Chattanooga.

L. Coes & Co., of Worcester, Mass., who claim to manufacture the best wrench for railroad purposes, have plenty of work on hand.

John Robbins, of Boston, Mass., manufactures nickel badges of fine quality for conductors and other railroad employes.

The Wrought Iron Bridge Co., of Canton, O., have just completed extensive improvements in their shops, increasing their facilities for bridge work. They have also built a new superintendent's office and an additional drafting room. A number of last year's contracts are being completed, and many new ones have been secured. They employed last year about 260 men, and during the nine months ending Dec. 31, used 6,000,000 pounds iron, and put up 322 bridges.

One of Alger's friction excavators, in use by Farwell, Sage & Co., contractors, at Long Island City, N. Y., excavated 217,000 cubic yards of earth last year.

The Ohio Falls Car Works, at Jeffersonville, Ind., recently shipped some passenger coaches for the Pekin, Lincoln & Decatur road.

The Birmingham Iron & Steel Works, at Birmingham, Conn., have suspended payment. The company has a valuable property, and it is thought that the embarrassment is only temporary, and that an arrangement can be made with the creditors.

The Brooks Locomotive Works, at Dunkirk, N. Y., have five engines to build for the Erie Railway.

Mr. J. M. Ayer, of Chicago, has contracted to build 50 of his refrigerator cars for the St. Louis, Iron Mountain & Southern road and 100 for the Anhauser Brewing Association, of St. Louis.

The Vulcanized Fibre Co., of New York, recently sold 13,500 of its car-box washers or dust-guards to the Pennsylvania Railroad Company. A great number of these are already in use.

H. A. Ramsey & Co., have a contract for an iron highway bridge 112 feet long over the Baltimore & Potomac road at Argyle avenue, Baltimore. The contract price is $11,500.

The Colwell & Collins Norway Bolt Co., at Cleveland, O., is running full time and making 45,000 bolts per day.

The Diamond State Car Spring Co., of Wilmington, Del., has just received an order for 1,000 of the Eureka spring for the Central Pacific road.

The Passaic Rolling Mill, at Paterson, N. J., has been shipping a lot of beams, etc., for the New York Elevated Railroad.

The Pennsylvania Iron Works, at Danville, Pa., are at work on a large order for iron rails, 56 lbs. to the yard, for the Rochester & State Line road.

The Catasauqua (Pa.) Manufacturing Co., has re-elected David Thomas President; Oliver Williams, Treasurer; John Williams, Secretary.

The Ohio Iron Co., at Zanesville, O., has been running all its works steadily all winter, except the blast furnace, and that is to start up this month.

The Philadelphia reporter of the *Iron Age* reports about 70,000 tons of steel rails sold in that market in February, the largest lots being 15,000 tons to the Erie; 13,000 to the Central Pacific; 5,000 to the Chesapeake & Ohio, and 4,000 to the New York, New Haven & Hartford.

Osgood Bradley, at Worcester, Mass., recently completed two passenger cars and a postal car for the European & North American road. He is also building 150 box cars for the Hoosac Tunnel Line.

Work has been resumed at the rolling mill of the Washburn Iron Co., at Worcester, Mass., which has been closed since last November.

The Kellogg Bridge Co., of Buffalo, N. Y., has a contract for 290 feet of iron bridging for the Montclair & Greenwood Lake road.

The Springfield Iron Company.

Business not having been very brisk during the past winter this company has improved the opportunity of making some changes and improvements. In the works small cranes are now used for charging rail piles into the furnaces and a steam ram for pulling them out, and there is also machinery for carrying rails to the saws after rolling and for sawing, carving and carrying to the cooling bed, so that only one man is employed for all those operations. Some of the Siemens gas furnaces have been rebuilt so as to reheat the rail piles, and arrangements have been made to roll the light rails in double lengths (60 ft.), afterwards cutting them in two. It is believed that light rails of this length have not before been made as a regular practice.

The company has now orders enough to keep its mill busy for two or three months, but at very low prices.

Large Car Wheels.

The Grand Trunk Railway Company is about to build 400 new freight cars which will be carried on chilled cast iron wheels of 36 inches diameter.

The Tennessee River Bridge Contract.

The bids for the superstructure of the bridge over the Tennessee River six miles north of Chattanooga, Tenn., on the Cincinnati Southern road, were opened by the trustees March 2. The bridge, the masonry for which is already completed, is to be an iron truss bridge of eight spans, one draw-span, 290 feet; one channel span, 256¼ feet; two shore spans, 208¾ feet each, and four other spans, 207½ feet each, or 1,784 feet in all. There were eight bids, as follows:

Phœnixville Bridge Works, Clarke, Reeves & Co.	$117,355 90
Louisville Bridge & Iron Co	132,744 00
Claflin & Sheldon, Cleveland, O.	134,661 00
Detroit Bridge Co.	155,000 00
Keystone Bridge Works, Pittsburgh	155,026 05
Baltimore Bridge Co.	157,202 50
Keystone Bridge Works, second bid	159,102 10
American Bridge Co., Chicago	184,037 00

The contract was awarded to the lowest bidders, Clarke, Reeves & Co.

OLD AND NEW ROADS.

Cumberland & Pennsylvania.

The Court of Appeals of Maryland has decided to affirm the decision of the lower court in the cases of this road and its owner, the Consolidation Coal Company. The Court decides that there is no sufficient ground for the application for the forfeiture of charter. It decides that the general law of 1876 regulating tolls applies only to companies organized under that law or the general law of 1870, and consequently does not apply to the Cumberland & Pennsylvania. Finally it holds that the sale of the road to the Consolidation Coal Company is void, from want of power in the railroad company, and consequently that the power to fix its own tolls conveyed by the Consolidation Company's charter has no application in this case.

In the suit of the American Coal Company for an injunction to restrain the Cumberland & Pennsylvania Railroad from charging freights on coal higher than those fixed by the special act of 1876, the Court holds that the plaintiff is entitled to relief and remands the case to the Circuit Court for action.

The decision of the Court makes only a nominal change in the ownership of the road, as the Consolidation Company holds all the stock of the Cumberland & Pennsylvania. The point rests in the power to charge tolls, which is not the same in the charters of the two companies.

Maine Central.

The Maine Railroad Commissioners have lately inspected all the bridges on this road and pronounce them all in good condition except one at Sabbattisville, which is safe for the present, but is to be renewed next summer.

Southern Minnesota.

The purchasing bondholders met in St. Paul, Minn., March 3, and organized a new company under the Minnesota law. The name of the road will remain unchanged.

Wabash.

A despatch from Springfield, Ill., says that on March 1 counsel for E. S. Harding, a bondholder, filed a petition asking for the appointment of a receiver by the United States Circuit Court. Similar proceedings were also had in the United States Circuit Court for Indiana. No further information has been received, nor is it apparent whether Mr. Harding represents any considerable amount of bonds.

Chesapeake & Ohio.

Gen. W. C. Wickham, Receiver of this road, has addressed a memorial to the Virginia Legislature concerning the recent message of the Governor referring to this road. He holds that the company has done nothing to forfeit its charter, but has more than complied with its contract with the State; that the road has not cost an undue amount, considering the nature of the work, and that the State has not and is not likely to suffer any loss by the road.

The committees of both houses of the Legislature, to whom the Governor's message was referred, reported that there was no occasion for interference by the State in the foreclosure proceedings. Both houses thereupon decided not to take any action upon the Governo'r recommendations, and so the whole matter dropped.

The West Virginia Legislature has passed a bill providing against any possible forfeiture by re-enacting the charter of the company and giving it until Jan. 1, 1882, to extend the road from Huntington to the mouth of the Big Sandy River.

Louisville, Cincinnati & Lexington.

The Auditor's report for January is as follows:

	1877.	1876.	1875.
Passengers	$34,575 79	$36,293 65	$35,038 01
Freight	47,349 87	37,189 82	42,838 37
Express, mail, etc.	6,108 24	6,532 52	5,170 12
Total earnings	$88,033 90	$80,015 99	$83,046 50
Expenses and renewals	66,221 02	58,665 70	62,142 30
Net earnings	$21,812 88	$21,350 29	$20,904 20
Taxes	1,166 00	1,311 75	1.311 75
Rentals and guarantees	2,070 97	3,650 07	4,357 16
Construction and improv't	65 66	467 82	.....
Total	$3,302 63	$5,429 64	$5,668 91
Net profit	$18,510 25	$15,920 65	$15,235 29

The earnings this year were $423 gross, and $105 net per mile; the expenses were 75.25 per cent. of earnings.

Wallkill & Valley.

In pursuance of a decree of foreclosure of the first mortgage granted by the New York Supreme Court, Frederick L. Westbrook, Referee, will sell this road at public sale in Kingston, N. Y., April 26. The sale will include the completed road from Montgomery, N. Y., to Kingston, 33 miles, all the franchises, etc., and the right of way or other property acquired by the company for the proposed extensions from Kingston to Albany, and from Montgomery to the Erie Railway.

Delaware & Hudson Canal.

The application for a receiver was renewed by Mr. Anderson, a stockholder, his bill containing the same allegations as the previous one, of extravagant management, unprofitable leases and other actions to the detriment of the stockholders. The company's reply was a general denial and rebuttal of the charges. Argument on both sides was heard by the New York Supreme Court March 6, and on the following day the Court decided to refuse the application.

Hannibal & St. Joseph.

The Supreme Court of Missouri has decided against the claim of this company that, according to its charter, it could only be required to pay taxes on the valuation made and returned by its own officers. Under this decision the company is liable to pay some $47,000 back taxes in excess of the amount already paid.

Lafayette, Muncie & Bloomington.

A bill has been filed in the United States Circuit Court asking for the appointment of a receiver for this road. The bill is filed by some of the bondholders with the purpose of getting out the present management. A similar application has been before the courts before.

East Gore Branch.

It is proposed to build a branch line from the Intercolonial at Elmsdale, N. S., to East Gore, about 14 miles. The line would open up several valuable deposits of coal, lime and slate, especially slate. A subsidy from the Province is asked for.

Central, of New Jersey.

In pursuance of the power given him by the Chancellor to preserve the Lehigh & Susquehanna lease, Receiver Lathrop paid promptly the March coupons on the Lehigh Coal & Navigation gold loan, which the Central assumed when it leased the road.

There has been talk of trouble among the employes and even of a general strike if they did not receive their back pay soon, but though there is doubtless some discontent the men seem generally willing to wait until legal means of relief can be had. The general law authorizing the payment of arrears of wages in similar cases has passed the lower house of the New Jersey Legislature, and will probably pass the Senate this week, as there is no opposition to it.

A Philadelphia dispatch of March 6 says that the Lehigh Coal & Navigation Company on that date served formal notice on the Central that it would re-enter upon possession of the Lehigh & Susquehanna road unless all arrears of rent were paid up in ten days.

Boston & Maine.

This company claims now to have all the enginemen it needs. The trains which were taken off when the strike began have been put on again, and the road is being run regularly on the old time-table. The enginemen, however, still say that they have hopes of final success, and even claim that many of the stockholders believe that they are in the right, and are opposed to the present management of the road.

New York & Manhattan Beach.

Work is said to be progressing rapidly on the grading of this road. The company has let contracts for a depot and a repair shop at Greenpoint, N. Y., and has received two engines for the road. The expectation is that the line from Greenpoint to Bay Ridge and Coney Island will be ready for the pleasure travel of next Summer.

Erie.

Receiver Jewett has received the certificate of the London trustees to the effect that a majority in amount of the first consolidated bondholders have signed the reconstruction agreement. It is stated that the coupons which became due on the first consolidated bonds Sept. 1, 1876, will now be paid, and that the Receiver has obtained an order from the Court authorizing him to issue special certificates to raise the money required.

South Shore.

Steel rails are now being laid on the entire length of this road from Braintree, Mass., to Cohasset, 11½ miles.

New Orleans, Jackson & Great Northern.

At the adjourned meeting of the bondholders in New York, March 5, the committee presented a report recommending that the holders of the consolidated bonds of this road and the Mississippi Central should buy the roads at the foreclosure sales and organize a consolidated company to be known as the Illinois, St. Louis & New Orleans. The plan includes a new general mortgage to provide for all prior liens and improvements on the road; a second mortgage to replace the consolidated mortgages and the issue of stock for the overdue coupons. The report was approved and the committee continued with power to act as recommended.

St. Louis, Iron Mountain & Southern.

The annual meeting was to have been held in St. Louis, March 6, but was postponed on account of a controversy as to the voting of 25,000 shares of stock placed in the hands of Baring Brothers, of London, to be held in trust as security for unpaid coupons on bonds held in England. Two parties claimed the right to vote on these shares, and one of them, Mr. S. G. Ward, of New York, agent for the Barings, procured from the St. Louis Circuit Court an injunction restraining the other parties, President Allen and Vice-President Marquand, from voting on them. Subsequently Mr. Allen procured a modification of the injunction, prohibiting any election at all until further order of the Court. The modified order was served while the election was in progress, and the meeting thereupon adjourned. The case will be argued on its merits in a few days. It is said that Mr. Ward's intention was to elect a new board and throw out Messrs. Allen and Marquand entirely.

Ohio & Mississippi.

After hearing arguments on the question of removing the Receivers, the United States Circuit Court on March 3 gave its decision. The Court said that when the Receivers were appointed the right had been reserved to parties interested to apply for their removal. The present application was therefore considered not so much as an application for a change as for an original appointment. Taking this view, the Court believed that but one receiver was required, and as a large number of both stockholders and bondholders had expressed approval of Mr. John King, Jr., it would appoint him. The objection made as to his connection with the Baltimore & Ohio was not regarded as having weight against him. The Court further stated that there was no reflection cast upon the character or ability of Mr. Torrance by this change. An order was directed to be entered appointing John King, Jr., sole Receiver and giving Messrs. King and Torrance 30 days to settle their accounts.

The Court also entered an order authorizing the Receiver to pay the October coupons on or before April 1. Another order allowed T. J. Emery, J. J. Emery and W. D. F. Manice to appear in the case as defendants and to file a cross-bill contesting the purchase of the Springfield & Illinois Southeastern road.

Vermont Valley.

The United States Circuit Court has directed a final order to be entered setting aside the alleged lease to the Central Vermont and directing possession of the road to be given to the stockholders. The road is 24 miles long, from Brattleboro, Vt., to Bellows Falls, and is the connecting link between the Vermont Central and Rutland roads and the Southern lines to Springfield and New London. A controlling interest in the stock is, we believe, owned by the Connecticut River Railroad Company, but that company's road is separated from it by 10 miles of line now worked by the Central Vermont under lease. A connection could be made on the New Hampshire side of the Connecticut River by building about six miles of road and using four miles of the Ashuelot road from South Vernon to Hinsdale. The Vermont Valley road, however, has no northern connection not controlled by the Central Vermont, but by its control of this link the Connecticut River Company may be able to make such terms with the Central Vermont as to secure what it very

much desires, an open connection with the Passumpsic road and its line to Montreal.

Gilman, Clinton & Springfield.

The English bondholders' committee reports that the most pressing liabilities are the foreclosure expenses and the sum needed to complete the work of putting the road in good condition, about $300,000 in all. They recommend that the purchasing bondholders organize a new company under the laws of Illinois, and that stock be issued to the amount of the old bonds and new 7 per cent. currency bonds to the amount of $300,000 to meet the requirements stated above, the bonds to run ten years and the company to reserve the option of paying them off sooner. With the road and equipment in good condition it is believed that a fair dividend can be paid on the new stock. The new stock will be $1,000,000 and the bonds $300,000; the estimated net earnings for last year were nearly $110,000, which would pay the $21,000 interest and nearly 4½ per cent. dividend.

Missouri Pacific.

This company and the St. Louis, Kansas City & Northern have agreed upon a division of business to and from competitive points, as is announced in the following circular to agents and connecting lines:

"On and after Thursday, March 1, 1877, the following division of territory will go into effect, viz.:

"The Missouri Pacific Railway Company will not receive for transportation, to or from St. Louis, or east thereof, any freight destined for or coming from St. Joseph, Council Bluffs, or any point via or on the Kansas City, St. Joseph & Council Bluffs, or St. Joseph & Denver City railroads.

"The St. Louis, Kansas City & Northern Railway Company will not receive for transportation, from or to St. Louis, or east thereof, any freight coming from or destined to Atchison or Leavenworth, Kan., Lincoln, Neb., or Lexington, Mo., or points beyond on any railroad connecting at those points.

"Freight for Omaha, Neb., and points beyond on the Union and Central Pacific railroads, will be received as heretofore by both companies."

European & North American.

This company's interest in the ferry across the harbor of St. John, N. B., was sold at sheriff's sale Feb. 26. The interest in the boats brought $8,500, and the lease of the St. John dock and ferry privilege, on which $2,167 were due, brought $10.50. It is thought that the purchasers will continue to run the ferry, though it is uncertain. Its stoppage would cause considerable inconvenience to the road.

Tuna Valley & Buffalo.

It is proposed to make a new outlet for the Tuna Valley oil region by building a railroad from Bradford, Pa., northeast through the Foster Brook valley to the Buffalo, New York & Philadelphia road at Olean, N. Y., about 15 miles. It is said that the route is a very favorable one. The oil business of the Tuna valley, though comparatively new, is already large, and is growing rapidly. Its present outlet is over the Buffalo, Bradford & Pittsburgh Branch of the Erie.

Chicago, Danville & Vincennes.

As already noted, the United States Circuit Court last week directed an order to be entered confirming the sale of the Illinois Division. The Court declined to make any order for the distribution of the proceeds of the sale until the Master's report was completed and all the claims submitted. An appeal from the order of confirmation was asked for, which the Court granted, requiring the appellants to file bonds and specifying that appeal should not operate as a *supersedeas*.

Atlantic & Gulf.

In the suit begun by the bondholders the United States Circuit Court has appointed Messrs. John Screven and Samuel A. Strang Receivers. Mr. Screven is President of the company, and Mr. Strang is a lawyer of New York. They have duly qualified and taken possession of the property, which will remain in the immediate charge of General Superintendent Haines, the Receivers having appointed him their agent.

At an adjourned bondholders' meeting in Savannah, Feb. 22, a statement was made as to the purpose of the suit in which the Receivers were appointed. The committee appointed at the previous meeting was discharged and a new committee appointed with instructions to confer with counsel for the Trustee under the consolidated mortgage and to examine monthly the Receivers' accounts.

Chicago, Dubuque & Minnesota.

A Dubuque (Ia.) dispatch says that a new complication has arisen, the Forbes or Boston party among the bondholders having begun suit to recover a large amount from the Joy party, which has had the management of the case, for damages caused by advantages charged to have been taken in the sale of the bonds, and by mismanagement of the property.

Solomon, Arkansas River & Eastern.

This company has recently been organized to build a railroad from Beloit, Kan., on the Solomon River southward through Bavaria, Barton, Sedgwick and Sumner, to Wellington, in Sumner County; thence eastward through Oxford, Winfield and Independence to Oswego, there to connect with the Missouri & Western road. The whole length of the projected line is about 290 miles, the section from Beloit to Wellington, 100 miles, running at right angles to the Kansas Pacific and the Atchison, Topeka & Santa Fe and to the general direction of Kansas traffic, and the remaining 130 miles, from Wellington to Oswego being parallel to and about 15 miles north of the Indian Territory line. For business from almost any part of the north and south line it would be a very indirect route eastward.

Jacksonville, Pensacola & Mobile.

The sale of this road by the State of Florida has been postponed to June 4, at Tallahassee.

Atlantic, Mississippi & Ohio.

The English and Dutch bondholders' committee have agreed to co-operate, and the management of their joint interests is to be intrusted to a joint committee of four. The English members of the joint committee are Capt. Tyler and Mr. John Collinson.

Boston & Albany.

At the adjourned stockholders' meeting, Feb. 28, it was voted to approve and ratify the leases of the Pittsfield & North Adams and the North Brookfield railroads. The terms of these leases have already been given; that of the Pittsfield & North Adams is a renewal of a 20 years' lease which has expired.

Lexington & St. Louis.

This road was sold in St. Louis March 1 under a trust deed for $900,000, and was bought in for $150,000 by Joseph Seligman, of New York, Trustee under the mortgage. In addition to the first mortgage there is a second mortgage for $800,000 and a floating debt of about $200,000. The road is 55 miles long, from Sedalia, Mo., to Lexington, and has been worked as a branch of the Missouri Pacific.

Chicago, Rock Island & Pacific.

Notice is given that this company will receive at the office of F. H. Tows, Treasurer, No. 13 William street, New York, until April 14, proposals for $8,000,000 of 6 per cent. 40 year bonds to be issued under the new general mortgage whose proposed execution was noted last week. The new bonds will bear interest from July 1, 1877, will be registered or coupon bonds as desired and full payment will be required on June 20, when the bonds will be delivered. A deposit of 5 per cent. must accompany all bids. No bids under par will be received, but the company will accept in payment its outstanding 7 per cent. bonds at 5 per cent. premium and accrued interest to July 1.

Newburg, Dutchess & Connecticut.

This and not Newburg & Connecticut, as heretofore stated, is the name of the new company organized by the bondholders who lately bought the Dutchess & Columbia road at foreclosure sale.

Vaca Valley & Clear Lake.

A company by this name has been organized in California for the purpose of extending the Vaca Valley Railroad, a branch of the California Pacific, from its present terminus northward to Cache Creek and thence northwest through Cache Creek Canon to Clear Lake, about 55 miles. The capital stock is to be $1,000,000.

Clove Branch.

This road has heretofore been worked as a branch of the Newburg, Dutchess & Connecticut road. It is hereafter to be run as an independent road under its own organization. It is 4¼ miles long, from Clove Branch Junction, N. Y., to Silver Lake, and was built to open up some large deposits of iron ore.

Hamilton & Northwestern.

The Georgetown Division of this road is now completed and opened for traffic from Hamilton, Ont., northward to Georgetown, 34 miles.

Spartanburg, Union & Columbia.

This is now the name of the road formerly known as the Spartanburg & Union, which extends from Spartanburg, S. C., south by east to the Greenville & Columbia at Alston, 69 miles.

Walla Walla & Columbia River.

Regular trains are now being run on this road from Walla Walla, Wash. Ter., westward to Wallula on the Columbia River. The road is of 3 ft. gauge and is equipped with 3 engines, 1 passenger and 23 freight cars.

New Jersey & New York.

The sale of the locomotives on this road did not take place March 3 as advertised, Receiver Lary having procured a temporary injunction prohibiting it. The question as to the right of the Rogers Locomotive Works to make the sale was to be argued before the Chancellor of New Jersey this week.

Union Pacific.

By agreement between the companies three directors of this company have been elected directors of the Chicago & Northwestern and the Chicago, Rock Island & Pacific, and three gentlemen who are directors in those companies have been chosen to seats in the Union Pacific board. The change is said to be made in order to secure harmony between the management of the company and that of its connecting lines.

St. Louis & Southeastern.

The Auditor's report for January is as follows:

	Earnings.	Expenses.	Net earn.	P. c. of exps.
St. Louis Division	$47,964 87	$36,753 04	$10,211 83	76.57
Kentucky Division	29,451 14	20,239 91	9,211 23	68.61
Tennessee Division	13,840 91	9,475 75	4,365 16	68 66
Whole road	$91,256 92	$66,468 70	$24,788 22	72.80

As compared with January, 1876, there is an increase of $13,414.98, or 12.9 per cent., in gross, and of $13,377.24, or 117.3 per cent. in net earnings.

Gulf, Colorado & Santa Fe.

This company is making arrangements to contract for an additional section beyond Arcola, Tex., the present terminus, which is 45 miles from Galveston.

Rhode Island & Massachusetts.

The grading of this road is now well advanced all along the line from Valley Falls, R. I., to Franklin, Mass., and the first lot of rails has been delivered at Valley Falls.

Eastern.

The Boston *Advertiser* says: "A new plan has been perfected in part for the management of the Eastern Railroad, of which the following are the principal features: The general management of the road, which is understood to cover both the operating and the business departments, is to be under the personal charge of the President. The operating department is divided into three sub-departments, transportation, maintenance of way, and rolling stock. There is to be a master at the head of each of these three sub-departments, who is to have exclusive control of all employes in the department and will report to the President. The business department is divided into three sub-departments, ticket, freight and purchasing, at the head of which there is a general agent, who has the exclusive charge of the affairs of his department and will report to the President. The six heads of departments—Master of Transportation, Master of Maintenance of Way, Master of Rolling Stock, General Ticket Agent, General Freight Agent and General Purchasing Agent—will be the general officers of the road, appointed by the President, with the approval of the board of directors."

Pittsburgh, Virginia & Charleston.

Two preliminary lines, one on each side of the Monongahela River, have been surveyed for the proposed extension of this road from Monongahela City, Pa., to Brownsville. The final location has not yet been decided. The distance is about 20 miles.

Columbus & Gallipolis.

This company, which purchased the graded road-bed and other property of the old Gallipolis, McArthur & Columbus road, is making arrangements to resume work. A mortgage for $1,500,000 has been executed and recorded, but no bonds are to be issued until a part of the road is completed. It is expected that work will be begun not later than June 1.

Georgia Railroad Projects.

The late Legislature of Georgia granted charters to the following companies:

Herndon & Swainsboro, to build from the Central road at Herndon west by south to Swainsboro, about 25 miles.

Fort Gaines & Pataula, to build from Fort Gaines on the Chattahoochee north to Pataula in Quitman County, about 15 miles.

Gainesville Branch, to build a short line in Hall County.

Augusta & Knoxville, to build a line from Augusta up the Savannah and Tugalo rivers and through Rabun Gap to a connection with the Western North Carolina, about 150 miles.

Keokuk & Des Moines.

A general reduction of 10 per cent. in the wages of employes was made March 1.

Texas & Pacific.

Through business for the Houston & Texas Central road, which has heretofore been sent over the main line to Dallas, will hereafter go over the Transcontinental Division and will be transferred to the Houston & Texas Central at Sherman.

Surveys are being made for an extension of the Transcontinental Division westward. The company's propose is understood to be to build about 12 miles from Sherman and establish at the terminus extensive stock-yards. The object is to reach a point where the cattle trade can be accommodated in the most convenient way and to avoid the necessity of driving stock into Sherman.

The subsidy bill failed to pass at the late session of Congress, the time of both houses having been so fully occupied otherwise that the bill was not considered at all. There is no doubt, however, that it will be actively pressed when the next Congress meets.

Raleigh & Augusta Air Line.

Some time since Josiah Turner sued out an injunction to stop the exchange of bonds between this company and the State of North Carolina, alleging fraud in the passage of the act authoring the exchange. The Superior Court afterwards dissolved the injunction, but Mr. Turner appealed. The Supreme Court now refuses to entertain the appeal, which ends the matter.

Windsor & Annapolis.

This company asks the Government of Nova Scotia to guarantee the interest on $250 000 new bonds which are to be issued to raise the money needed to put the road in good condition and to make certain improvements.

Georgia.

This company procured from the Legislature of Georgia at its late session an act authorizing it to buy or lease the Macon & Augusta road, in which it already owns a controlling interest. Another act gives it authority to buy or lease the Port Royal Railroad.

Lockport & Buffalo.

The New York Central & Hudson River Company recently applied to the Supreme Court for orders to compel this company to change the line of this road now under construction, the object being to require it to cross the Central track at Tonawanda above grade. This would have required the construction of some additional track to make the connection with the Erie at Tonawanda. After hearing argument, however, the Court refused the application.

Louisville, New Albany & St. Louis.

The bondholders who bought this road at foreclosure sale have organized a new company and will, it is said, make arrangements to complete it to New Albany, about 100 miles eastward from the present terminus at Princeton, Ind. A good deal of expensive work was done on this section several years ago. Only 28 miles of the road, from Princeton, Ind., west to Albion, Ill., are in operation.

St. Louis, Kansas & Colorado.

The St. Louis *Republican* continues to advocate the construction of a narrow-gauge road from St. Louis westward into Kansas with a possible extension to Colorado and branches to Nebraska and Texas. There has been some response from towns which expect to be on the line, but little or no action has been taken in St. Louis as yet, although the road is advocated especially in the interest of that city.

Iron Mountain, Chester & Eastern.

The people along the line are trying to raise the money to lay iron on some 20 miles of this road which was graded several years ago from St. Mary, Mo., on the Mississippi, westward to West Plains. A little money and a good deal of land has been subscribed, and the company will not object to the use of the road-bed.

Lewisburg, Centre & Spruce Creek.

Tracklaying has begun on an extension of this road from Laurelton, Pa., west by south to Spring Mills in Centre County, about 21 miles.

Mobile & Girard.

The Alabama Legislature has passed an act asked for by this company, authorizing it to execute a mortgage and issue bonds under the same.

Augusta & Knoxville.

This company's charter was passed by the Georgia Legislature, and arrangements are being made to organize the company and begin work.

Indianapolis, Lafayette & Bloomington.

A company by this name has filed articles of incorporation in Indiana, and purposes building a railroad from the Lafayette, Muncie & Bloomington at Frankfort southeast to Indianapolis, about 40 miles.

Bangor & Calais Shore Line.

The directors have finally resolved not to stop work, as the subscribing towns desired, but to go on, and to sue the towns for their subscriptions.

Fall River.

This company asks the Massachusetts Legislature for leave to issue $75,000 preferred stock, to fund its floating debt.

Waynesburg & Washington.

A contract has been concluded for the iron for this road with the Riverside Iron Co., of Wheeling, W. Va., at $40 per ton on the cars at Wheeling. The board has called in the balances due on subscriptions to the stock.

Marshall & Coldwater.

Amended articles have been filed, changing the northern terminus of this projected road to Mt. Pleasant, in Isabella County, Mich., and increasing the capital stock to $150,000. It is said that work will be resumed very soon.

North Brookfield.

This company has voted to ratify the lease of the road to the Boston & Albany. The lease is for ten years, and the rental is to be 25 per cent. of the gross earnings, after deducting the taxes and $2,000 per year for use of equipment.

Clay Centre, Hanover & Beatrice.

A company by this name has been organized to build a railroad from Clay Centre, Kan., the terminus of a branch of the Kansas Pacific, northward through Hanover to Beatrice, Neb., about 65 miles. The capital stock is to be $600,000.

Eastern Counties

Work was begun on this road at New Glasgow, N. S., last week, and the contractor has a considerable force employed there.

Somerset.

A special meeting of the stockholders was to be held at West Waterville, Me., March 1, "to consider the propriety of uniting with the Maine Central Railroad Company, on condition that said company will extend their road from Skowhegan to Norridgewock."

Skowhegan is the terminus of the Maine Central's Androscoggin Division, and is six miles eastward from Norridgewock; but the object of the proposed extension is not very clear.

New York Central & Hudson River.

The Rochester (N. Y.) *Union* says: "The Central Railroad Company has prepared plans for a line of elevated tracks through this city, beginning at St. Paul street, on the east, with a grade which will gradually ascend to an elevation of more than 15 feet above the street levels, and terminating at Canal street on the west side of the city. The plan contemplates carrying two tracks elevated, and if it is adopted, the Niagara Falls Branch of the road will be adopted in the city except for local freight. That road will connect with the ele-

vated track about a mile west of the canal on the Buffalo Branch. The State Line road will also be permitted to run their passenger trains on the elevated tracks to the Central depot."

Ithaca, Auburn & Western.

Ties are now being distributed along the line of this road from Scipio to Auburn, 12 miles; most of the grading on that section was done four years ago. For the 10 miles from Ormond to Ithaca, which is to complete the Ithaca connection, it has been resolved to follow the old Murdock line, which is nearly all graded.

Hannibal & St. Joseph.

The Kansas City *Times* says: "Last October the head of the mechanical department on the Hannibal & St. Joe Railway cut down engineers' and firemen's wages and inaugurated a system of discharging old and tried men and substituting men from other roads. Of course this action caused dissatisfaction widespread and deep-seated, which culminated a short time since in the Brotherhood of Locomotive Engineers sending a delegation to New York to interview the President and directors of the road. Meanwhile, it is said, the leading merchants and business men of Hannibal had forwarded to the same headquarters a numerously-signed petition, asking the removal of Mr. Symonds, Master Mechanic of the road. The result has been that the old, reliable engineers have been reinstated, with wages restored to the former standard.

"It is also rumored that Mr. Symonds has been removed, in accordance, it is supposed, with the wishes of the business men of Hannibal."

St. Paul & Pacific.

The St. Paul *Pioneer-Press* of Feb. 23 says: "Mr. J. M. Gilman, in the Senate yesterday, in behalf of the conflicting parties in the St. Paul & Pacific Railroad legislation, reported that they had agreed upon a bill, the features of which are as follows: The forfeiture is removed from the St. Vincent Branch on condition that the company shall build from Melrose to Sauk Center by July 1, 1878; from Sauk Center to Alexandria by Jan. 1, 1879; from Alexandria to Fergus Falls, and from Crookston to St. Vincent by Jan. 1, 1880; from Fergus Falls to Glyndon by Jan. 1, 1881. The Brainerd Branch remains subject to the forfeiture process, unless before May 1, 1877, the 'Bond Company' shall signify its intention to build the line from Watab to Brainerd within one year, and shall deposit $15,000 as a guarantee to be forfeited in case of failure so to build. In the new bill the provision for the protection of settlers and for the Minnesota creditors remain the same as in the so-called compromise bill."

Marietta & North Georgia.

The Georgia Legislature has passed and the Governor approved a bill to loan to this road the net receipts of the State from convict labor for four years, as aid to the completion of the road. The estimated amount of the loan is about $20,000 per year, or $80,000 in all.

Central, of Iowa.

In consequence of the light business and small earnings for some time past, the Receiver has decided to reduce the pay of employes about 10 per cent. The employes have been promised their pay promptly hereafter, on the 15th of each month.

Boston, Wrentham & Providence.

The board of directors has been considering the question of an entrance into Boston for this projected narrow-gauge road, and decides that it would be best to come in by a tunnel through Beacon Hill. It is thought the line into the city would be used by other projected narrow-gauge lines, tolls being charged for its use.

ANNUAL REPORTS.

Pennsylvania.

The annual report of President Thomas A. Scott for the year ending Dec. 31, 1876, is published this year a week in advance of the annual meeting. It gives the following statements of the operations of the road for the year.

The statements cover the main line from Philadelphia to Pittsburgh, 358 miles; the branches in Pennsylvania, 605 miles; the United New Jersey lines, 293 miles; the Belvidere Delaware and the Flemington railroads, 80 miles; the Philadelphia and Erie, 288 miles, and the Delaware and Raritan Canal, 66 miles—in all, 1,624 miles of railroad and 66 of canal. The line owned is the 358 miles of main line and 98 miles of branches, but the company owns a controlling interest in most of the Pennsylvania branches. The earnings of this property for the year were:

	1876.	1875.	Inc. or Dec.	P. c.
Gen'l freights	$21,132,560 23	$22,807,660 00	Dec.. $1,675,099 77	7.3
First-class passengers	13,152,867 44	8,660,646 63	Inc... 4,492,220 81	51.9
Emig'ant passengers	184,671 56	196,973 04	Dec.. 12,301 48	6.5
Expr'ss matter	598,719 10	652,118 39	Dec.. 53,399 29	8.2
Mails	377,747 68	291,672 59	Inc... 86,075 09	29.5
Miscellaneous	561,943 20	787,373 15	Dec.. 225,429 95	28.6
Canal earnings	882,551 78	1,067,660 58	Dec.. 185,108 80	17.3
Total earn.	$36,891,060 99	$34,464,104 38	Inc... $2,426,956 61	7.0
Cond't'g transportation	8,134,868 53	7,498,663 92	Inc... 636,204 63	8.5
Motive power	6,283,018 90	5,913,644 81	Inc... 369,374 09	6.2
Maintena'ce of cars	1,997,347 83	1,921,260 51	Inc... 76,087 32	4.0
Maintena'ce of road	4,713,385 40	4,743,255 57	Dec.. 29,870 17	0.6
Gen'l expenses	420,302 64	476,600 74	Dec.. 56,298 10	11.8
Canal expenses	532,308 02	541,035 76	Dec.. 8,729 74	1.6
Tot'l exp's.	$22,081,229 34	$21,094,461 31	Inc... $986,768 03	4.7
Net earnings	$14,809,831 65	$13,369,643 07	Inc... $1,440,188 58	10.8
Rentals and interest on equipment	1,975,445 87	1,946,446 85	Inc... 28,999 02	1.5
Balance	$12,834,385 78	$11,423,196 22	Inc... $1,411,189 56	12.4

The report says: "The earnings per mile received from the 358 miles of Main Line in 1876 were $51,916.92, showing an increase of earnings per mile of $620.99 over the earnings of 1875.

"The actual cost of operating your Main Line in 1876, excluding branches, was 58.70 per cent. of its receipts, and including branch lines, 59.9 per cent. In 1875 the cost of operating your Main Line, excluding branches, was 55.87 per cent., and including branches, 57.55 per cent. The expenses of 1876 include many unusual outlays, made to meet the possible requirements of the Centennial Exhibition.

"The actual cost of operating the United Railroads of New Jersey, including branches, also the Belvidere Delaware Division and the Delaware & Raritan Canal, in 1876, was 58.8 per cent of the receipts from transportation; in 1875 it was 68.19 per cent.

"The actual cost of operating the United Railroads of New Jersey, including branches, in 1876, was 56.9 per cent. of the receipts from transportation. In 1875 it was 68.19 per cent.

"The actual cost of operating the Belvidere Delaware Railroad, including Flemington Branch, in 1876, was 74.5 per cent. of its receipts. In 1875 it was 71.27 per cent.

"The actual cost of operating the Delaware & Raritan Canal was 59.4 per cent of its receipts. In 1875 it was 50.67 per cent.

The distribution of net earnings was as follows:

Net earnings		$14,809,831 65
Less interest or rental of equipment, Phila. & Erie, Belvidere Delaware and branch roads		343,901 98
Balance		$14,465,929 67
Interest and dividends on investments		2,832,572 69
Interest on United New Jersey investments		252,559 51
Total available for interest, etc.		$17,551,061 87
Interest on bonded and floating debt	$3,571,126 41	
Four quarterly dividends, 2 per cent. each	5,509,587 00	
State tax on dividends	495,862 83	
State of Pennsylvania on account of purchase of Main Line	460,000 00	
Rent, Harrisburg & Lancaster Railroad	134,228 56	
Phila. & Erie Railroad, net earnings	920,547 22	
Branch roads in Pennsylvania, rentals, etc.	500,630 19	
Dividends, interest and rentals, United New Jersey lines	4,409,520 97	
Centennial construction and expense acct.	115,855 23	
		16,117,358 41
Balance		$1,433,703 46
Add profit on sundry items, open accounts		77,281 03
Total to credit of profit and loss		$1,510,984 49

The contingent fund of $2,000,000 has been merged in profit and loss account; adding this and the balance above and deducting charges made to reduce the insurance fund, for depreciation of materials, loss on open accounts, etc.; one-half the subscription to Centennial stock and the discount on the Navy Yard bonds, the balance of profit and loss at the close of the year was $10,054,197.03.

The work done and the average result was as follows:

	Main line and branches.	United New Jersey.	Belvidere Delaware.	Phila. & Erie.
Mileage of road	963	293	80	288
Passengers carried	6,926,016	....	....	691,560
Passenger mileage	288,312,089	302,188,535	10,282,524	22,425,613
Tons freight carried	9,922,911	3,377,605	1,246,967	2,517,470
Tonnage mileage	1,629,742,021	190,635,678	60,970,796	340,390,703
Average receipt per pass. per mile	1.862 cts.	2.213 cts.	2.291 cts.	2.317 cts.
Average cost per pass. per mile	1.029 "	0.966 "	2.074 "	2.104 "
Average net per pass. per mile	0.833 "	1.247 "	0.217 "	0.243 "
Average receipt per ton per mile	0.892 "	1.787 "	1.049 "	0.776 "
Average cost per ton per mile	0.582 "	1.562 "	0.782 "	0.504 "
Average net per ton per mile	0.310 "	0.225 "	0.267 "	0.272 "

The average receipt per passenger per mile for the whole line was 2.056 cts.; cost 1.055 cts.; net, 1.001 cts. The passenger mileage showed an increase over 1875 for the main line and branches of 79.7 per cent.; for the United New Jersey lines of 86.3 per cent.; for the Belvidere Delaware of 58.9 per cent.; for the Philadelphia & Erie of 48.3 per cent., and for the whole system of 81 per cent. There was also an increase of tonnage mileage on every division, being 16.2 per cent. on the Main Line and branches; 1.6 per cent. on the United New Jersey; 29.3 per cent. on the Belvidere Delaware; 9.1 per cent. on the Philadelphia & Erie, and 9.65 per cent. for the entire system.

The report says: "The exceedingly low average earning on both freight and passenger business is attributable chiefly to two causes: The first was the unwise competition in all through competitive traffic forced upon the trunk lines under the seriously mistaken policy which endeavored to secure to certain of the trunk lines more than a due proportion of through business; an attempt which, while depriving the lines in great part of the profit which should legitimately result from their operation, failed to accomplish the object sought to be attained. The second cause of the low rate of earning was the policy adopted by the company of aiding the mining and manufacturing interests of the Commonwealth, and especially of those along its line, by making temporary reductions in its freight rates during the severe depression which continued in all branches of trade throughout the year. Your board believe this latter course to have been judicious; otherwise, a large number of important industries could not have remained in active operation. By the most rigid economy in every department, and by the thorough maintenance of the road and equipment, the cost of movement per ton per mile was reduced to less than six mills—certainly a gratifying result. There has been moved over the main line and branches during the year 8 86-100 per cent. more tonnage than in any like period since their construction.

"In the month of December, 1876, an arrangement was entered into between the several trunk lines, under which a considerable advance was secured upon the then prevailing unremunerative rates on through traffic. It is hoped that this may be improved upon, and be made permanent, by adopting a proper system for dividing the business or its results, so that each of the various lines may have insured to it a proper share of the traffic and the public be thereby relieved from the uncertainties and disadvantages attending the fluctuations of irregular rates. This done, the companies will be enabled to give greater facilities to the public and make sufficient profit in their operation to protect and remunerate the capital invested in them. This policy has received the earnest support of your board of directors, and it is believed that during the present year such a permanent plan as is above alluded to may be agreed upon, greatly to the benefit of the business interests of the country and to the owners of railway property.

"Before the close of the past year negotiations were concluded with the Baltimore & Ohio Railroad Company, whereby all the business that is competitive only between that company and your own has been placed on a basis to make all such traffic remunerative. This arrangement has been of great service to both companies, and will no doubt result in still further measures for the better protection and promotion of the interests of the respective companies."

The operations of the branches in Pennsylvania were as follows:

	1876.	1875.	Increase.	P. c.
Mileage	605	547	58	10 6
Gross earnings	$2,201,838 61	$2,129,308 07	$72,530 54	3.4
Expenses and rentals	2,116,352 14	2,087,124 98	29,227 16	1.4
Net profit	$85,486 47	$42,183 09	$43,303 38	102.6

The earnings of the Philadelphia & Erie for the year were $3,352,979.17; working expenses $2,188,445.92, and interest on equipment $243,986.03, leaving a net balance of $920,547.22.

The report does not give any separate statement of earnings of the United New Jersey lines, nor of the net result of the lease.

During the year 5,999 tons of steel rails were laid on the Main Line, 7,068 tons on the New Jersey lines and 3,854 tons on the Philadelphia & Erie. There were built at the Altoona shops and charged to expenses, 49 engines and 733 freight cars to replace old ones worn out; 126 passenger and 2 mail cars were built and charged to construction, being in addition to the equipment. Arrangements have been made for 1,000 new coal cars from the Car Trust of Pennsylvania. The block system of signals is now in use over the whole Main Line from Jersey City to Pittsburgh. The actual expenditure for new work during the year was:

Construction, Pennsylvania R. R.	$943,778 35
" United New Jersey R. R.	280,869 69
Equipment	646,159 34
Real estate, exclusive of Navy Yard purchase	477,396 07
Extensions and new work on branches and connections	738,821 87
Total	$3,087,025 32

It is believed that not over $2,000,000 will be required for the present year. Contracts have been made with the Cambria Iron Works and the Pennsylvania Steel Works under which those works have been running during the winter on the steel rails needed for renewals during the current year. They are paid in certificates, redeemable on delivery of the rails as required. Orders have been given to complete the bridge over the Monongahela at Turtle Creek and the connection there with the Pittsburgh, Virginia & Charleston road, which will complete a second connection with the Pittsburgh, Cincinnati & St. Louis entirely outside of Pittsburgh.

The earnings of the Pennsylvania Canal were $409,773.46; expenses, $241,081.41; net earnings, $168,692.05, and the sum of $47,620.69 in addition was recovered from the State for taxes overpaid.

The Susquehanna Coal Company produced 568,371 tons of coal with a net profit, after paying all expenses and interest, of $14,060.06. The Summit Branch Company produced 241,706 tons with a net profit of $87,740.46; the Lykens Valley Company 155,165 tons with a net profit of $139,838.39; the Mineral Railroad & Mining Company 320,700 tons with a net profit of $90,494.86.

The summing up for all the lines east of Pittsburgh is as follows:

	1876.	1875.	Increase.	P. c.
Gross earnings	$36,891,060 99	$34,464,104 38	$2,426,956 61	7.0
Expenses and rentals	24,056,675 21	23,040,908 16	1,015,767 05	4.4
Net balance	$12,834,385 78	$11,423,196 22	$1,411,189 56	12.4

The operations of the lines west of Pittsburgh leased and controlled by the Pennsylvania Company were as follows:

Gross earnings	$24,670,150 30
Expenses	17,414,507 55
Net earnings	$7,255,642 75
Rentals, interest, dividends and all liabilities	7,291,496 87
Loss for the year	$35,853 82

The expenditure for construction and equipment was $558,399.21 during the year. There were laid on these lines 20,514 tons of steel rails, the entire cost on the Southwestern lines being charged to betterments, but on the Northwestern lines only the difference between cost of steel and iron. The report says: "It has been frequently charged by parties inimical to your company's welfare that there were very large amounts of Pennsylvania Company's paper issued to the Pennsylvania Railroad Company for accommodation purposes and indorsed by it. This statement is absolutely without foundation, as all of the Pennsylvania Company's paper in existence has been issued for the proper and necessary purposes of its own and subordinate lines.

"On Dec. 31, 1876, the bills payable of the Pennsylvania Company had been reduced to $2,588,933.47. Of this amount the Pennsylvania Railroad Company received the sum of $2,155,233.47 for advances made to the Pennsylvania Company to meet the requirements of the companies west of Pittsburgh in providing for the necessary construction and equipment on their lines during past years, and for other outlays requisite for the proper protection and improvement of the large properties committed to their charge. Of the above amount received by the Pennsylvania Railroad Company $2,050,000 have been discounted, with its indorsement, to partly reimburse it for its advances to the Pennsylvania Company. It is proposed that all the floating indebtedness of the Pennsylvania Company shall be funded at an early date."

The summing up for the entire system is as follows:

	East of Pitts.	West of Pitts.	Total.
Passengers carried	18,363,366	7,030,359	25,393,7 5
Passenger mileage	623,208,761	259,353,848	882,562,609
Tons freight carried	18,962,661	12,129,970	31,092,631
Tonnage mileage	2,221,739,198	1,373,123,363	3,594,862,558
Gross earnings	$36,891,060 99	$24,670,150 30	$61,561,211 29
Working expenses	22,081,229 34	17,414,507 55	39,495,736 89
Net earnings	$14,809,831 65	$7,255,642 75	$22,065,474 40

The report says of the Centennial business: "In order to accommodate the immense passenger traffic of the Centennial year, it was necessary to make important changes in the system of tracks in the West Philadelphia yards, and at the new Centennial station, all of which were accomplished in time to meet the requirements of the company. A large passenger station was built immediately opposite the main entrance to the Centennial grounds, and the tracks for the incoming and outgoing trains were constructed in the form of a circle, so that there could be a continuous arrival and departure of trains without interference. This plan worked most satisfactorily; the risk of collisions or other accidents to trains was avoided, and the company was not only enabled to provide for the increased number of trains over its own lines, but to furnish accommodations for the North Pennsylvania and Bound Brook lines, and for the Philadelphia, Wilmington & Baltimore Railroad. The movement of all passenger and freight trains to and from the Centennial grounds and the station at West Philadelphia, was placed under the immediate charge of Charles E. Pugh, with a sufficient corps of officers under him to take prompt care of the great concentration of traffic at those points.

"During the Centennial season, between the 10th of May and the 10th of November, 20,231 passenger trains, with 127,296 cars and 2,343,499 passengers, arrived at the West Philadelphia station, Thirty-second and Market streets, and during the same period 22,372 trains, with 141,284 cars and 2,612,213 passengers, arrived at the Centennial station, making a total of 42,603 trains, with 268,580 cars and 4,955,712 passengers. This large movement was accomplished without the slightest injury to any passenger. During the period referred to 90 per cent. of this whole amount of passenger traffic was handled between the hours of 7 and 11 o'clock in the morning and 4 and 7 o'clock in the afternoon.

"The total amount of baggage received and delivered at the West Philadelphia, Centennial, Kensington and Market Street Ferry stations was 730,486 pieces, and of this aggregate but 26 pieces were lost or mislaid, the claims for which, as presented, amounted to the small sum of $1,906.99.

"It is believed that the volume of the passenger and freight traffic of the lines controlled and operated by the Pennsylvania Railroad Company during the Centennial season was largely in excess of that ever handled by any other company. Its careful and successful movement reflects the highest credit upon the General Manager and the officers under his charge on the various divisions of the line.

"It is to be regretted that the rates received for this transportation were even less than that which your company, under the arrangements made between the different railway lines, expected to receive. But while the revenue from the largely increased traffic was diminished by the great reduction in the rates, no doubt these rates induced a great many to visit the Exhibition that otherwise could not have done so. We trust that we shall see some important results in the future from the travel of the past year."

It is believed that the establishment of the permanent exhibition will bring considerable traffic to the company's lines hereafter.

Notwithstanding the heavy traffic of the year the road has been fully maintained and is believed to be in better condition than ever before, and able to carry an extensive traffic with the greatest possible economy.

JUST PUBLISHED:

"RAILWAY DISBURSEMENTS

And the Accounts into which they are Naturally Divided."

BY MARSHALL M. KIRKMAN.

This work is intended to give full and minute instructions for the guidance of those agents and employes of railroad companies who may be entrusted with the disbursing of the money or material of the corporation, in such manner as to insure the strict accounting for everything, leaving no loopholes for undetected waste or wrongful appropriation of the company's property.

The book consists chiefly of formal rules, illustrated by forms of the blanks recommended and referred to. These rules are the result of many years' experience, most of them having been practically applied and amended from time to time as seemed advisable to make them thoroughly effective and perfectly clear. It is believed that they will be, for the most part at least, found applicable on all American railroads, and can be issued as instructions to employes accordingly.

The most complete and exact rules for keeping railroad accounts ever published. Price $2, postage paid. Published by the *Railroad Gazette*, 73 Broadway, New York.

THE CATECHISM OF THE LOCOMOTIVE,

By M. N. FORNEY,

Mechanical Engineer,

is an elementary treatise on the Locomotive, written in the form of questions and answers. The book contains 609 pages and 250 engravings, including 16 full-page plates of different styles of locomotives.

The principles of operating and details of construction are so clearly explained as to enable any intelligent person to thoroughly understand them. The book is written without the use of technical terms or abstruse mathematical calculations, and is intended for all classes of readers.

No popular treatise on the locomotive in the English language gives so clear, simple and complete a description of the construction and working of the locomotive engine, and no work of any kind, however extensive, gives so full an account of modern American practice in locomotive construction, and of the latest scientific discoveries which have application to the operation of the locomotive, especially those relating to combustion, heat, etc., all of which the author has endeavored to make plain to those who have not even the rudiments of a scientific education.

Price $2.50. Address *The Railroad Gazette*, 73 Broadway, New York.

THE RAILROAD PROBLEM.

A Lecture delivered before the Lowell Institute, Boston,

By CHARLES FRANCIS ADAMS, Jr.

Revised by the author. Issued in a neat pamphlet. The latest utterance of the most eminent student of the relation of railroads to the State Price 15 cents. Address

The *Railroad Gazette*, 73 Broadway, New York.

THE VERRUGAS VIADUCT

Compared with Several Other Viaducts,

By MR. ERNEST PONTZEN, an eminent Austrian Engineer; accompanied by a two-page engraving of the Verrugas Viaduct, and a letter by Mr. Charles Bender, C.E., on "German Theorists and American Bridge Engineering." Mr. Pontzen gives a brief description of the ten most celebrated viaducts in Europe and a detailed account of the Verrugas Viaduct in Peru, together with comparisons of their cost and methods of construction. A valuable pamphlet for engineers to study and preserve for reference. Price, 40 cents. Address, The *Railroad Gazette*, 73 Broadway, New York.

ZELL'S ENCYCLOPEDIA.
NEW REVISED EDITION.
AGENTS WANTED.

150,000 articles, 3,000 engravings and 18 splendid maps. The BEST BOOK of universal knowledge in the language. Now in course of publication. SPECIMEN with map sent for 20 cents.

By addressing the publishers, canvassers will learn of a new plan by which the work is selling rapidly.

T. Ellwood Zell, Davis & Co., Phila.
E. W. BOND, 5 Beekman st., New York

SEAMLESS STEEL WARE & FROG CO.,
HARRISBURG, PA.

Frogs,
Switches,
Crossings,
Steel Barrows,
Other R. R. Supplies.

Descriptive circulars sent upon application.
C. H. JACKSON, Manager.

RUBBER ELASTIC PAINT,
FOR
CAR ROOFS AND SHOPS.

E. MAXWELL & CO.,
719 North Main Street,
ST. LOUIS, MO.

EMPLOYMENT.

[*Advertisements of situations wanted or of officers or employes wanted will be inserted under this heading for* TWO CENTS PER WORD *for the first publication and* ONE CENT PER WORD *for each subsequent insertion. Payment must be made in advance. Letters forwarded.*]

POSITION DESIRED BY A CIVIL ENGINEER, expert in locating and rearranging alignment and GRADES for present economical construction, and especially FUTURE ECONOMICAL OPERATION. Skilled in PRACTICAL MECHANICAL detail of planning and constructing railway works and MACHINERY. United States and Spanish-American experience. Speaks Spanish. Address ECONOMICAL OPERATION, *Railroad Gazette* office.

ASSISTANT SUPERINTENDENCY OR Mastership of Roadway and Machinery desired by an engineer, PRACTICAL, progressive and systematical in ECONOMICAL RAILROAD OPERATION. Address ASSISTANT SUPERINTENDENT, this office.

A GRADUATE OF THE THAYER School of Civil Engineering (in connection with Dartmouth College), desires an engagement. Is willing to commence in almost any position where ability and skill will secure promotion. Address A. H. PORTER, Montour, Iowa.

A GENTLEMAN OF LITERARY ACquirements, well esteemed as a public writer, and of large and varied business experience, would be glad of some employment requiring capacity, industry and thorough integrity. Address WALTER, *Railroad Gazette* office.

POSITION DESIRED ON SOME LIVE Railroad. Am well posted as to general Railroad Accounts and the Freight traffic. Railroad managers desiring an energetic and competent man will address "AUDITOR," RAILROAD GAZETTE Office, 73 Broadway, New York.

WANTED—A SITUATION AS SHORThand writer for some railway official. 6 years' experience. GEO. P. BENEDICT, Litchfield, Mich.

WANTED AND FOR SALE.

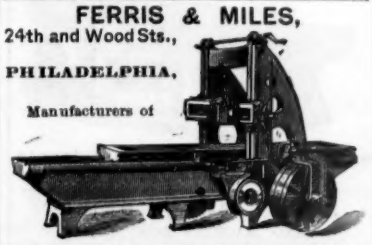
[*Lists of machinery or supplies ready for delivery and announcements of wants will be inserted under this heading at* THREE CENTS PER WORD, PER WEEK, OR TEN CENTS PER WORD FOR FOUR WEEKS. *Payment must be made in advance.*]

FOR SALE—AN ENGINEERING AND Surveyor's office, with a good local practice, and with all maps and data. Address PRESTON LITTLE, C. E., Trenton, N. J.

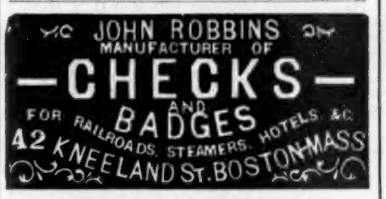
CATALOGUE OF
RAILROAD PAMPHLETS,
Reports, Etc., Now Ready.
SEND TO
E. P. BOON, Agent, 86 Nassau street, N. Y.

THE LANE & BODLEY CO.,
John and Water Sts., Cincinnati,
Manufacturers of their Perfectly Graduated
Stroke Power
MORTISING MACHINE
Hangers, Pulleys, Couplings and Shafting.
LOWEST PRICES AND BEST QUALITY.
Send for our Price Lists.

FERRIS & MILES,
24th and Wood Sts.,
PHILADELPHIA,
Manufacturers of



Engine Lathes, Axle Lathes, Planing and Slotting Machines, Wheel Borers, Upright Drills, Radial Drills, Punching and Shearing Machines, &c. Steam Hammers Drops, &c.



WILL APPEAR PROMPTLY UPON CONCLUSION OF SITTINGS OF JURY.

OFFICIAL.

A COMPLETE REPORT OF THE TESTIMONY TAKEN BY A CORONER'S JURY, CONVENED DEC. 31, 1876, AT

ASHTABULA, OHIO,

in the case arising out of the failure of the

RAILWAY BRIDGE

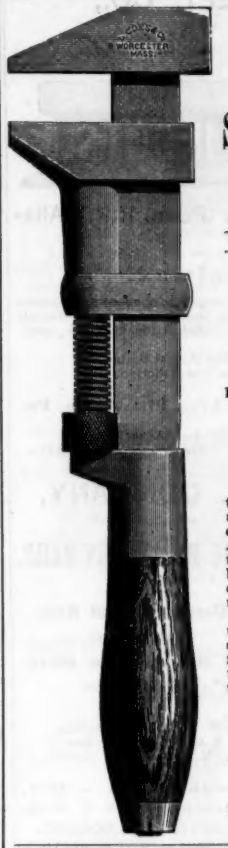
at that place, Dec. 29, 1876.

Printed, by authority, from the notes of the sworn stenographer to the Coroner and Jury; with maps of the railway station grounds, and of the village of Ashtabula; and several views and drawings, showing the wrecked bridge, generally and in detail, and illustrating the statements of experts, witnesses before the Jury.

Royal octavo, about 450 pp.; with plates.

Edited by J. M GOODWIN, C. E., Mem. Am. Soc. C. E., Railway Expert and Associate Counsel to the Jury, to whom orders may be sent, at Cleveland, Ohio.

Price, $3.00.
Cleveland: Robison, Savage & Co., 1877.



L. COES'

GENUINE IMPROVED PATENT

Screw Wrenches

MANUFACTURED BY

L. COES & CO.,

Worcester, Mass.

Establish'd in 1839.

Registered March 31, 1874.

We invite the particular attention of the trade to our New Straight Bar Wrench, *widened*, full size of the larger part of the so called Lindsay's "REINFORCED OR JOG BAR." Also our enlarged jaw, made with ribs on the inside having a full bearing on front of bar (see sectional view), making the jaw fully equal to *any* strain the bar may be subjected to.

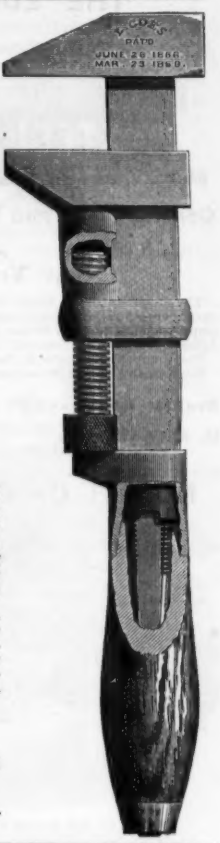
These recent improvements in combination with the nut inside the ferrule firmly screwed up flush, against square, solid bearings (that cannot be forced out of place by use) verifies our claim, that we are manufacturing the strongest Wrench in the market.

None genuine unless stamped

"L. COES & CO."

Warehouse, 97 Chambers and 81 Reade Streets, New York.

HORACE DURRIE & CO., Agents.



LUDLOW VALVE MFG. CO.,

OFFICE AND WORKS:

938 to 954 River St. and 67 to 83 Vail Ave., Troy, N.Y.

VALVES

(Double and Single Gate, ½ in. to 48 in.—outside and inside Screws, Indicator, &c.) for Gas, Water and Steam. Send for Circular.

Also, FIRE HYDRANTS.

PEET VALVE COMPANY

152 Hampden Street, Boston, Mass.,

MANUFACTURERS OF

Quick-opening Valves,

FOR

RAILROAD WATER TANKS;

Also Valves for Steam, Water, Gas, &c.

In use on the BOSTON & ALBANY; BOSTON, CLINTON & FITCHBURG; NEW YORK & NEW ENGLAND, and other roads.

CHERRY HEAT WELDING COMPOUND.

SCHIERLOH MANUFACTURING COMPANY,

Office, 24 Exchange Place, Jersey City, N. J.

OFFICE OF PURCHASING AGENT,
Lake Shore & Michigan Southern R'y.,
Cleveland, O., March 1, 1876.

IRON CLAD PAINT CO., Cleveland, O.:

Gentlemen—Your "Metallic Paints," known as "*Iron Clad Paints*," have in the past nine years been extensively used and thoroughly tested by this Company as to their *covering capacity, durability and resistance to atmospheric changes*, latter "paint destroyer" the most difficult to overcome in outside paints. We have used over 100 tons and can emphatically accord them the highest position over any paint heretofore produced for Cars, Roofs, Stations, Bridges, &c. The monthly increase of our orders is the best evidence that your paint is constantly growing in favor with our mechanics.

Very respectfully yours,

A. C. ARMSTRONG

Gen'l. Purchasing Agent,
L. S. & M. S. R'y. Co.

THE EDGAR THOMSON STEEL CO., LIMITED,

MANUFACTURERS OF

STEEL RAILS. BLOOMS & INGOTS

General Office and Works at Bessemer Station (Penn. R.R.), Allegheny County, Pa.

New York Office, No. 57 Broadway.

The members of the Edgar Thomson Steel Company, Limited, have had large experience in manufacturing and in railway management; their works are the most complete in the world, with all the late improvements, and are located in the best Bessemer metal district in the United States, and their managing officers are experienced in the manufacture of Bessemer Steel.

The Company warrants its rails equal in quality to any manufactured in the United States.

Rails of any weight or section furnished on short notice. Orders for trial lots solicited.

Branch Office and P. O. Address, No. 41 Fifth Ave., Pittsburgh, Pa.

D. McCANDLESS, Chairman. **WM. P. SHINN, General Manager.**

NORTH CHICAGO ROLLING MILL COMPANY,

WORKS OF THE NORTH CHICAGO ROLLING MILL COMPANY.

MANUFACTURERS OF

PIG METAL, IRON RAILS,

AND

Bessemer Steel Rails.

OFFICE:

17 Metropolitan Block, CHICAGO.

O. W. POTTER, President.
S. CLEMENT, Treasurer.
R. C. HANNAH, Secretary

Established - - 1857.
Incorporated - - 1869.
CAPITAL, $3,000,000.

The Company possesses facilities for the production of Iron and Steel Rails of BEST QUALITIES. Any of the usual patterns of rails supplied on short notice. New patterns will be made to order.
Capacity of Works, 50,000 tons Iron and 50,000 tons Steel per annum.

SPRINGFIELD IRON COMPANY — BROAD & NARROW GAUGE RAILS — SPRINGFIELD, ILLINOIS.

Orders Solicited for Iron Rail Of any Weight not Less than 30 lbs. per yd.

RE-ROLLING PROMPTLY DONE

On the Most Favorable Terms.

The Iron Rail Piles made by this Company are all heated with Siemens' Gas Furnace, thereby securing perfect welds.

CHARLES RIDGELY, President.
JOHN W. BUNN, Vice-President.
GEO. M. BRINKERHOFF, Sec'y.

Capacity of Works 3,000 Tons per Month.

THE ALBANY & RENSSELAER IRON & STEEL CO.

ERASTUS CORNING, Pres.; CHESTER GRISWOLD, V. Pt.;
SELDEN E. MARVIN, Sec'y & Treas.; JAMES E. WALKER, Gen'l Manager.

TROY, N. Y.

NEW YORK OFFICE, 56 BROADWAY.

PROPRIETORS OF

The Albany Iron Works, The Rensselaer Iron Works, The Bessemer Steel Works, The Fort Edward Blast Furnace, The Columbia Blast Furnace.

Manufacturers of Bessemer Steel and Iron Rails, Fish-Plates, Bolts and Nuts for Fish-Joints, Railroad Frogs, Railroad, Boat and Ship Spikes. All sizes Merchant and Angle Iron, Merchant, Bar and Spring Steel, Bessemer Steel Shafting, Crow-Bars and Cut and Clinch Nails, Boiler Rivets, Finger Bars and Shapes, Railroad Car, Truck and Engine Axles.

WALKER'S PATENT IMPROVED HORSE-SHOES.

We refer with especial pleasure to the quality of the articles manufactured by us, and warrant the same equal to any other manufactures in the United States.

All orders addressed to us will receive prompt attention.

THE STANDARD STEEL WORKS.

Locomotive and Car-Wheel Tires

Manufactured from the celebrated OTIS STEEL.

BRAND

STANDARD.

Quality and efficiency fully guaranteed. Prices as low as any of the same quality. We also manufacture

Heavy and Light Forgings, Driving and Car Axles, Crank Pins, Piston Rods, &c., &c.

Works at Lewistown, Pa. Office, 218 S. 4th St., Philadelphia, Pa.

THE CAMBRIA IRON WORKS,

situated on the line of the Pennsylvania Railroad, at the western base of the Allegheny Mountains, are the largest of their class in the United States, and are now prepared to make **2,000 tons per week of Iron and Steel Railway Bars.**

The Company possesses inexhaustible mines of Coal and Ore, of suitable varieties for the production ron and Steel Rails of BEST QUALITY.

Their location, coupled with every known improvement in machinery and process of manufacture enables them to offer Rails, when quality is considered, at lowest market rates. Address

CAMBRIA IRON COMPANY, No. 218 South Fourth street, Philadelphia, or at the Works, Johnstown, Pa., or J. S. KENNEDY & CO. Selling Agents, No. 41 Cedar street, New York.

THE MASON MACHINE WORKS,

TAUNTON, MASS.

WM. MASON, Prest. WM. H. BENT, Treas. FRED'K MASON, Agent.

BUILDERS OF ALL KINDS OF

LOCOMOTIVES,

INCLUDING DOUBLE-TRUCK LOCOMOTIVES FOR WIDE OR NARROW-GAUGE RAILROADS.
ALSO ALL KINDS OF COTTON MACHINERY

THE CLEVELAND ROLLING MILL COMPANY,

CLEVELAND, OHIO,

MANUFACTURERS OF

Bessemer Steel and Iron Rails,

From 25 lbs. to 70 lbs. per yard,

AND FASTENINGS,

BOILER PLATE, TIRE, AXLES AND OTHER FORGINGS,

Of Siemens-Martin and Bessemer Steel, and of Iron.

Galvanized and Black Sheet Iron.

CORRUGATED ROOFING AND SIDING.

SPRING STEEL AND WIRE OF ALL KINDS.

WIRE CLOTH.

Agents for the Sale of Steel Screws of all Sizes.

Using Lake Superior Iron Ore, from its own mines, and having a long experience in manufacturing, company can warrant the quality of its products.

A. B. STONE, President, 20 Nassau st., New York.

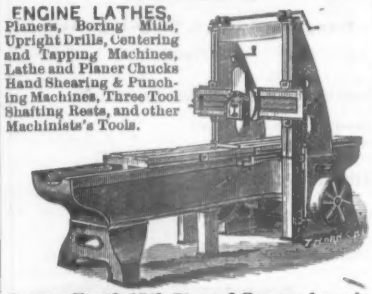
H. CHISHOLM, Vice-Pres. and Gen. Manager, Cleveland, O.

EDWIN HARRINGTON & SON,

MANUFACTURERS OF

ENGINE LATHES,

Planers, Boring Mills, Upright Drills, Centering and Tapping Machines, Lathe and Planer Chucks Hand Shearing & Punching Machines, Three Tool Shafting Rests, and other Machinists's Tools.



Corner North 15th St. and Pennsylvania Avenue, Philadelphia, Pa.

MORSE TWIST DRILL

AND MACHINE COMPANY,

MANUFACTURERS OF

TAPS, DIES, SCREW PLATES, Etc.

These tools are furnished with V or U. S. standard shape of threads and any desired pitch or number of threads per inch. Having completed our special gauges and machinery for making the U. S or Flat Top and Bottom of thread, we invite attention of R. R. men to our manufacture of long shank or nut taps, which we in all cases guarantee against imperfections such as fire cracks, temper or gauge.

For descriptive circular of Machinists', Blacksmith, Pipe and other taps, and screw plates, etc., send to

H. S. MANNING & CO.,

Sole agents for the sale of above tools,

111 LIBERTY STREET, NEW YORK.

PHOSPHOR BRONZE SMELTING WORKS.

C. J. A. DICK, Proprietor,

2038 Washington Avenue, Philadelphia, Pa., Patentee and sole manufacturer of Phosphor Bronze in the United States.

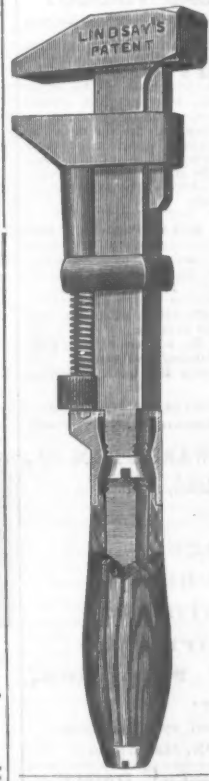
REGISTERED TRADE MARK:

"Phosphor-Bronze."

Several principal railway corporations are using Phosphor Bronze bearings exclusively.

Particulars on application at the works, or to licensed founders: Geo. K. Treon, Callowhill, west of Broad street, Philadelphia; Atwood & McCaffrey 50 to 60 Third avenue, Pittsburgh.

THE CELEBRATED LINDSAY WRENCH.



The Lindsay Wrench was very favorably received by the Master Mechanics when first introduced.

We have added the "Coes'" improvements to that of Lindsay, and claim to make now the strongest wrench known.

Manufactured under John P. Lindsay's Patent, Dec. 12, 1865.

A. G. Coes' Patent, May 2, 1871.

A. G. Coes' Patent, Dec. 26, 1871.

F. L. Coes' Patent Aug. 1, 1876.

Manufactured expressly for Railroad use.

A. G. COES & CO., Worcester, Mass.

CAST STEEL WORKS

OF FRIED. KRUPP,

Essen, Rhenish Prussia.

TIRES, AXLES SPRING STEEL, Crank Pins, Connecting Rods, Piston Rods, Boiler Plates, &c., &c.

Special Tool Steel,

A Very Superior Article, Suitable for All Kinds of Cutting Tools, Dies, &c.

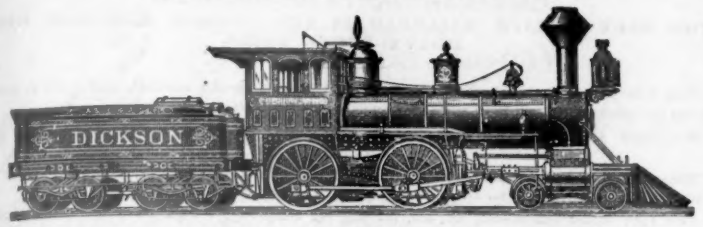
Represented by

THOS. PROSSER & SON,

15 Gold street, New York.

DICKSON MANUFACTURING COMPANY

Scranton and Wilkesbarre, Pa.



Manufacturers of Locomotives adapted to every kind of service. Pumping and Mining Machinery a specialty. Cars, Car Wheels, Forgings and Machinery of all kinds. Specifications promptly furnished on application.

GENERAL OFFICE, Scranton, Pa.

G. L. DICKSON, President. W. H. PERKINS, Treasurer. W. B. CULVER, Gen. Sup't.

THE HINKLEY LOCOMOTIVE WORKS,

439 ALBANY STREET, BOSTON,

MANUFACTURE

Locomotive Engines and Tenders, Boilers and Tanks,

Gun Metal and Common Iron Castings, Brass and Composition Castings.

LOCOMOTIVES AND BOILERS REPAIRED.

☞ Sole manufacturers of the "HINKLEY PATENT BOILER." All orders will be executed with dispatch.

ADAMS AYER, Pres't. F. L. BULLARD, Treas. FRANK D. CHILD, Sup't.
GEO. F. CHILD, Secretary. H. L. LEACH, General Manager.

ROGERS LOCOMOTIVE AND MACHINE WORKS

Paterson, N. J.; New York Office, 44 Exchange Place.

MANUFACTURERS OF

Locomotive Engines and Tenders and Other Railroad Machinery.

J. S. ROGERS, President.
S. S. HUGHES, Secretary.
WM. S. HUDSON, Supt. } PATERSON, N. J.

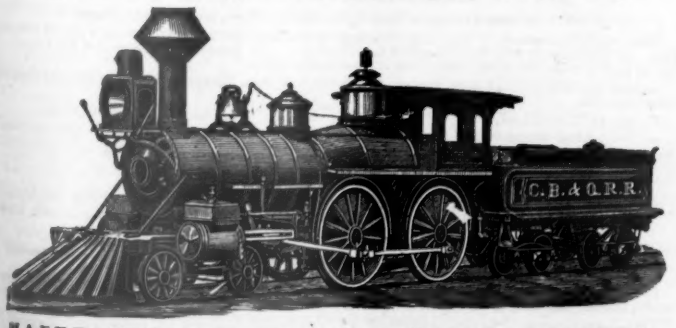
R. S. HUGHES, Treas.,
44 Exchange Place, New York.

TAUNTON LOCOMOTIVE MANUFACTURING CO.,

P. L. PERRIN, Supt. [ESTABLISHED IN 1846.] HARRISON TWEED, Treas.

TAUNTON, MASS.

MANCHESTER LOCOMOTIVE WORKS,



MANUFACTURERS OF LOCOMOTIVE ENGINES.

All work accurately fitted to gauges. All parts duplicated and guaranteed of best material and workmanship.

ARETAS BLOOD, Agent, Manchester, N. H. JOHN A. BURNHAM, President.
WM. G. MEANS, Treas., Boston, Mass

PORTER, BELL & CO., Pittsburgh, Pa.

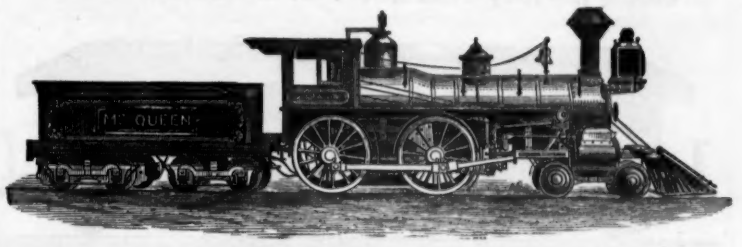
Exclusive Specialty: Light Locomotives

For Narrow-Gauge Passenger and Freight, Street Railway, Mine, Shifting, and all kinds of Special Service

All work built of best material to thorough system of standard templets and gauges.

OUR NEW CATALOGUE WILL BE MAILED ON APPLICATION.

SCHENECTADY LOCOMOTIVE WORKS,

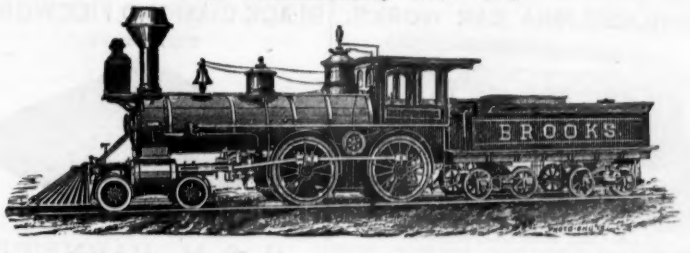


SCHENECTADY, N. Y.

JOHN C. ELLIS, Pres. CHAS. G. ELLIS, Treas. JOHN SWIFT, Supt

BROOKS LOCOMOTIVE WORKS,

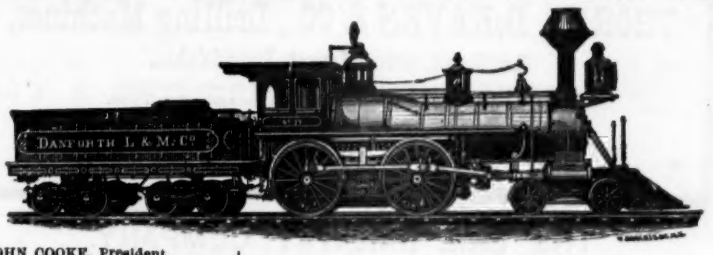
DUNKIRK, N. Y.



Orders Solicited for Locomotives Adapted for Every Class of Railway Service.

M. L. HINMAN, SEC'Y & TREAS. H. G. BROOKS, PRES'T & SUP'T

DANFORTH LOCOMOTIVE AND MACHINE CO.



JOHN COOKE, President.
J. T. BLAUVELT, Vice-President.
WM. BERDAN, Sec'y & Treasurer.
JAMES COOKE, Superintendent. } PATERSON, N. J.

New York Office, 52 Wall St
H. A. ALLEN, AGENT.

NATIONAL LOCOMOTIVE WORKS.

W. H. BAILY & CO.,

MANUFACTURERS of LOCOMOTIVES. LIGHT and NARROW-GAUGE LOCOMOTIVES A SPECIALTY
All Material and Workmanship Guaranteed to be of the Very Best.

OFFICE AND WORKS AT CONNELLSVILLE, PA.

PITTSBURGH LOCOMOTIVE & CAR WORKS,

PITTSBURGH, PA.

MANUFACTURERS OF

LOCOMOTIVE ENGINES FOR BROAD OR NARROW GAUGE ROADS,

From standard designs or according to specifications, to suit purchasers.

Tanks, Locomotive or Stationary Boilers Furnished at Short Notice.

D. A. STEWART, *Pres't*, WILSON MILLER, *Sec. and Treas*

J. M. JONES & CO., WEST TROY, N. Y.,

Manufacturers of STREET CARS (Exclusively),

Embracing every variety of Close and Open Cars for either one or two horses.

PASSENGER CARS,

Of the Finest Finish, as well as Every Description of CAR WORK, furnished at Short Notice and at Reasonable Prices by the

HARLAN & HOLLINGSWORTH COMPANY, Wilmington, Del.

PHILADELPHIA CAR WORKS.

J. G. BRILL & CO.,

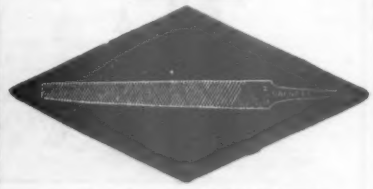
Manufacturers of cars of every description. Street Cars of the most approved styles. Narrow Gauge. Passenger and Freight Cars.

Thirty-first and Chestnut Streets, PHILADELPHIA.

☞ Cars built in sections for shipment.

BLACK DIAMOND FILE WORKS

TRADE MARK.



G. & H. BARNETT.

Nos. 39, 41 & 43 Richmond Street, PHILADELPHIA.

SEND FOR CATALOGUE.

THORNE, DeHAVEN & CO., Drilling Machines,

21st Street, above Market, Philadelphia.

PORTABLE DRILLS. Driven by power in any direction.
RADIAL DRILLS. Self-feed—Large Adjustable Box Table.
VERTICAL DRILLS. Self-feeding.
MULTIPLE DRILLS. 2 to 30 Spindles.
HORIZONTAL BORING AND DRILLING MACHINES.
HAND DRILLS. CAR BOX DRILLS.
SPECIAL DRILLS. For Special Work.

THE ERIE RAILWAY COMPANY.

TO THE TRAVELING PUBLIC.

During the Centennial Season—six months, closing November 10, 1876—the Erie Railway carried almost 3,000,000 passengers, without a single accident to life or limb, or the loss of a piece of baggage.

And for a whole year, the official records of the United States Post Office Department show the arrivals of Erie Railway trains in New York, on time, to be from 15 to 27 per cent. ahead of competing lines.

Facts well worthy the consideration of travelers.

E. S BOWEN, General Superintendent.

JNO. N. ABBOTT, General Passenger Agent.

THE ATLANTIC & GREAT WESTERN RAILROAD,

in connection with the

ERIE RAILWAY,

form the Great Broad-Gauge Route to the WEST and SOUTH. For Chicago, Cleveland, Omaha and all points in the Northwest. For Cincinnati, Louisville, St. Louis, Kansas City and points in the Southwest.

THIS IS THE ONLY LINE, in connection with the Erie Railway, which runs through sleeping coaches from New York and local stations to Chicago, Cleveland, Mansfield, Galion, Dayton and Cincinnati without change.

Special The Southern system of railways are now running palace sleeping coaches from Cincinnati (in direct connection with express trains on this line) to Memphis, Jackson and New Orleans; from Cincinnati to Nashville, Decatur, Montgomery, Mobile and New Orleans—making but one change from New York to any prominent point South—via this line.

For through tickets at lowest rates, palace coach locations, and further information concerning the route, please apply at ticket offices Erie Railway and at offices of connecting lines.

Ask for tickets via the Atlantic and Great Western Railroad.

P. D. COOPER, Gen. Supt., Cleveland, O.

W. B. SHATTUC, Gen. Passenger Agent, Cincinnati, O.

ONLY DIRECT LINE TO FRANCE.

The General Transatlantic Company's Mail Steamers Between New York and Havre, Calling at Plymouth, (G. B.), for the landing of Passengers.

The splendid vessels of this favorite route for the Continent (being more southerly than any other) will sail from pier No. 43, North River, as follows:

FRANCE (Trudelle).....SATURDAY, Jan. 27, at 3 p. m.
LABRADOR (Saglier).....SATURDAY, Feb. 10, at 3 p. m.

PRICE OF PASSAGE IN GOLD (including wine): First cabin, $110 to $120, according to accommodation. Second cabin, $72. Third cabin, $40.

Return tickets at reduced rates.

Steerage, $26, with superior accommodation, including wine, bedding and utensils, without extra charge.

LOUIS DE BEBIAN, Agent, 55 Broadway.

NEW YORK CENTRAL & HUDSON RIVER R. R.

THE ONLY 4-TRACK RAILROAD IN THE WORLD, ALL LAID WITH HEAVY STEEL RAILS.

This is the favorite route between the East and West, sixty miles the shortest, and eight to twelve hours the quickest between Boston and New England and the West.

Wagner Palace Sleeping and Drawing Room Cars Attached to All Trains.

Through cars New York and Boston to Buffalo, Niagara Falls, Cleveland, Toledo, Detroit, Chicago, Indianapolis, Louisville and St. Louis, &c. No extra charge via Niagara Falls.

New York Ticket Offices—252, 261, 413, 785 and 942 Broadway; 7 Park Place and Grand Central Depot.

C. B. MEEKER, GENERAL PASSENGER AGENT.

NEW YORK AND NEW ENGLAND RAILROAD.

FOUR POPULAR LINES.

New and popular line between Boston and Philadelphia without change of cars, via N. Y. & N. E. H. P. & F., N. Y., N. H. & H. Railroads. Transfer steamer Maryland (between Harlem River and Jersey City). Two express trains, each way, each week day, between Boston and Philadelphia. Most direct route between Boston and Brooklyn.

Elegant drawing-room cars on all trains. Baggage checked through.

A. C. KENDALL, Gen. Pass. Agent. **CHAS. P. CLARK, Gen. Manager.**

PENNSYLVANIA RAILROAD.

GREAT TRUNK LINE AND UNITED STATES MAIL ROUTE. THE BEST CONSTRUCTED AND MOST COMPLETELY EQUIPPED RAILWAY IN AMERICA.

Connecting **all the principal cities on the Atlantic Coast** with those in the **Mississippi Valley** and on the **Great Lakes. Through trains with Palace Cars attached, between New York, Philadelphia, Washington** and **Baltimore** and **Chicago, St. Louis, Cincinnati** and **Louisville.**

Baggage Checked to Destination. Fare always as low as by any other route.

For tickets, palace and parlor car accommodations, and all desired information, apply at the offices of the Company: Nos. 203 and 205 Washington st., **Boston;** No. 1 Astor House, Nos. 526 and 944 Broadway, and Desbrosses and Cortlandt street ferries, **New York;** Nos. 838 and 1348 Chestnut street, and Depot, Thirty-second and Market streets, **Philadelphia;** N. E. cor. Baltimore and Calvert streets, Union Depot and Northern Central Railway Depot **Baltimore;** N. E. corner Thirteenth street and Pennsylvania avenue, N. E. corner Sixth street and Pennsylvania avenue, and Baltimore and Potomac R. R. Depot, **Washington City.**

D. M. BOYD, Jr., General Passenger Agent.
FRANK THOMSON, General Manager

NORTH PENNSYLVANIA RAILROAD.

THE SHORT AND FAVORITE ROUTE FROM PHILADELPHIA

To the Lehigh, Wyoming and Susquehanna Valleys, Scranton, Elmira, Rochester, Buffalo, Niagara Falls New York State, the West and Northwest.

FAST TIME, SURE CONNECTIONS, PARLOR AND SLEEPING CARS.

Philadelphia Passenger Depot, Berks and American Streets.

FREIGHT FACILITIES!

Daily fast Freight Trains are run between Philadelphia and the above-named districts, delivering freight with regularity and dispatch on terms as low as any other route.

PHILADELPHIA FREIGHT DEPOT, FRONT AND NOBLE STREETS.

ELLIS CLARK, Gen'l Agent, Front and Willow Streets, Philadelphia.
Philadelphia City Offices: Fifth and Chestnut sts. and 733 Chestnut st.

THE BEST ROUTE TO INTERIOR PENNSYLVANIA.

Express Trains daily from Philadelphia to Reading, Harrisburg, Tamaqua Pottsville, Mahanoy City, Ashland, Shamokin, Danville, Williamsport, and all points on the Coal, Lumber and Ore Regions of the State.

EXPRESS TRAINS FROM ALLENTOWN FOR SAME POINTS IN CONNECTION WITH TRAINS OF CENTRAL RAILROAD OF NEW JERSEY FROM NEW YORK.

Purchase Tickets via Reading.

J. E. WOOTTEN, Gen. Supt., Reading.

C. G HANCOCK, Gen. Ticket Agent, Phila.

CLEVELAND, COLUMBUS CINCINNATI & INDIANAPOLIS RAILWAY,

THE GREAT CENTRAL TRUNK ROUTE TO THE

OHIO AND MISSISSIPPI RIVERS.

Evening trains leave CLEVELAND daily with Rotunda Sleeping Cars, for COLUMBUS, CINCINNATI, INDIANAPOLIS, LOUISVILLE, TERRE HAUTE, EVANSVILLE, ST. LOUIS and all points West and South.

Morning trains leave daily except Sunday, with through Palace Coaches, for COLUMBUS, CINCINNATI, INDIANAPOLIS, LOUISVILLE and ST. LOUIS without change.

This is the only line making direct connection with all the Principal Trunk Lines of the East for NASHVILLE, MEMPHIS, NEW ORLEANS and all points in Texas, either by way of LOUISVILLE or ST. LOUIS.

Direct connection at ST. LOUIS for all Railway Towns in Kansas, Nebraska and Colorado.

EQUIPMENT COMPRISES ALL VALUABLE IMPROVEMENTS.

THE BEST ROAD-BED AND SAFEST ROAD IN THE WEST.

Tickets by this route for sale at all regular ticket offices.

E. S. FLINT, General Superintendent.

S. F. PIERSON. General Ticket Agent.

UNION PACIFIC RAILROAD

VIA OMAHA.

THE ONLY DIRECT ALL RAIL ROUTE; being 226 miles the Shortest Route.

Salt Lake, Sacramento, San Francisco, and the Mining Districts of Utah, Montana, Nevada, California, Etc., Etc.

Five Hours the Quickest Route to Denver.

Close connections made at Cheyenne with Denver Pacific Railway. At Denver with the Colorado Central. At Golden City with Daily Coaches for the Mines. At Denver with Denver & Rio Grande Railway for all points in Southern Colorado, New Mexico and Arizona.

Baggage checked through from Chicago to Denver, and from Omaha to Salt Lake City, Sacramento, San Francisco, etc.

T. E. SICKELS, Chief Engineer and Superintendent.

THOS. L. KIMBALL, General Ticket Agent, Omaha, Neb.

EMPIRE LINE.

THE EMPIRE TRANSPORTATION COMPANY OFFERS TO THE BUSINESS COMMUNITY A RELIABLE FAST FREIGHT LINE BETWEEN THE EAST AND THE WEST AND THE GREAT OIL REGION OF PENNSYLVANIA,

Via the Philadelphia & Erie Railroad and its Connections.

IT OWNS AND CONTROLS ALL THE CARS OF ITS LINE, which are new and built expressly for its trade, and furnished with BROAD TREAD WHEELS, which enable it to run through irrespective of change of gauge, thus avoiding the injurious delays prevalent at transhipping points.

The Line is managed by men of long experience in the business, and no effort will be spared on their part to render satisfaction to its patrons.

Parties ordering goods from the East will please direct shippers to mark packages "EMPIRE LINE," and refer them to the agents of the company for shipping directions, &c., &c.

GEO. W. BISTINE, General Freight Agent, Philadelphia, Pa.
GEORGE M. BALL, Eastern Superintendent, Philadelphia, Pa.
GEO. W. CROSS, Western Superintendent, Cleveland, Ohio.

THE FAVORITE ROUTE---EAST OR WEST.

MICHIGAN CENTRAL RAILROAD,

AN IMPORTANT LINK IN THE

GREAT CENTRAL ROUTE

Between the East and West.

THREE EXPRESS TRAINS EACH WAY DAILY. THE ONLY LINE EAST FROM CHICAGO RUNNING THE CELEBRATED DINING CARS.

WAGNER SLEEPING AND PARLOR CARS.

THROUGH CARS FROM AND TO

CHICAGO, NEW YORK AND BOSTON.

H. B. LEDYARD, Gen'l Sup't, Detroit. HENRY C. WENTWORTH, Gen'l Pass. and Tkt. Agt., Chicago.

BALTIMORE & OHIO RAILROAD.

Leave New York from foot of Desbrosses and Cortlandt streets:

8:40 a. m. for Washington and the West, Richmond, Charleston and the South. Pullman Parlor cars from New York to Baltimore and Washington, making close connection for Cincinnati, St. Louis, Louisville, &c.

1 p. m. for Washington, Pittsburgh, Cincinnati, Chicago, and for Richmond, via Gordonsville. Pullman cars from New York to Baltimore and Washington.

9 p. m. daily for Washington, the South and West. Pullman's sleepers from New York to Baltimore and Washington, making close connections for Chicago, Cincinnati, Louisville, St. Louis, Pittsburgh, the South and Southwest. Connect at Washington with trains for Lynchburg, Florida, New Orleans and the South. For through tickets please call at Company's offices, 315 and 1,238 Broadway, New York; and at the ticket offices, foot of Cortlandt and Desbrosses streets; and Depot, Jersey City.

ASK FOR TICKETS VIA BALTIMORE & OHIO RAILROAD.

PHILADELPHIA, WILMINGTON & BALTIMORE RAILROAD.

The connecting link between the EAST, WEST, NORTH, SOUTH, the centre of the GREAT THROUGH LINE between the cities of **NEW YORK, PHILADELPHIA, BALTIMORE** and **WASHINGTON**, the only route between the EAST, WEST and SOUTHWEST, via WASHINGTON, D. C., and the shortest and only direct route between the NORTH and SOUTH.

In every respect a first-class Railway. Tickets via BALTIMORE for sale in all principal ticket offices throughout the country.

H. F. KENNEY, Superintendent.

GEO. A. DADMUN, General Ticket Agent.

General Offices at Philadelphia, Pa.

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

THE DIRECT ROUTE TO

MILWAUKEE, ST. PAUL AND MINNEAPOLIS,

And all portions of Wisconsin, Minnesota and Northern Iowa.

Purchase Tickets Via Milwaukee.

Passengers going via this NEW DIRECT ROUTE to Milwaukee leaves from and arrive at the most Central and best located Depots in Chicago, Milwaukee and St. Paul.

BAGGAGE CHECKED THROUGH BY THIS ROUTE!

Passengers from Chicago can obtain these Advantages only by taking the trains of Chicago, Milwaukee & St. Paul Railway, at Union Depot, corner West Madison and Canal streets.

SPECIAL NOTICE.

This Line connects more important Business Centres than any other route in the Northwest, is as short as the shortest, and is fully equipped with the best of Day and Sleeping Coaches.

A. V. H. CARPENTER, Gen. Passenger Agent, Milwaukee.

S. S. MERRILL, Gen. Manager, Milwaukee.

T. E. CHANDLER, Passenger and Ticket Agent, 37 West Madison street, Chicago.

CHICAGO & NORTHWESTERN RAILWAY.

This great corporation now owns and operates over two thousand miles of road radiating from Chicago like the fingers of a man's hand, its lines reach in all directions and cover about all of the country north, northwest and west of Chicago. With one branch it reaches Racine, Kenosha, **Milwaukee** and the country north thereof; with another line it pushes through Janesville, Watertown, Oshkosh, Fond du Lac, **Green Bay**, Escanaba to Negaunee and **Marquette**; with another line it passes through Madison, Elroy and for **St. Paul** and **Minneapolis**; branching westward from Elroy it runs to and through **Winona, Owatonna**, St. Peter, **Mankato**, New Ulm, and stops not until Lake Kampeska, Dakota, is reached; another line starts from Chicago and runs through Elgin and Rockford to **Freeport**, and, via the Illinois Central, reaches Warren, Galena and **Dubuque**; and the country beyond. Still another line runs almost due westward, and passes through **Dixon**, Sterling, Fulton, Clinton (Iowa), **Cedar Rapids**, Marshalltown, Grand Junction, Missouri Valley Junction, to **Council Bluffs** and **Omaha**. This last-named is the "Great Trans-Continental Route," and the *pioneer overland line* for **Nebraska, Colorado, Utah, Idaho, Montana, Nevada, California** and the Pacific Coast. It runs through the Garden of Illinois and Iowa, and is the best, safest, shortest and quickest route for **Omaha, Lincoln** and other points in Nebraska, and for **Cheyenne, Denver, Salt Lake City, Virginia City, Carson, Sacramento, San Francisco**, and all other points west of the Missouri River.

On the arrival of the trains from East or South, the trains of the **Chicago & Northwestern** Railway leave CHICAGO as follows

For **Council Bluffs, Omaha** and **California**—Two through trains daily, with Pullman Palace Drawing-Room and Sleeping Cars through to Council Bluffs.

For **St. Paul** and **Minneapolis**—Two through trains daily, with Pullman Palace Drawing Room Sleeping Cars attached, for St. Paul and through to Minneapolis.

For **Green Bay** and **Lake Superior**—Two trains daily, with Pullman Palace Cars attached.

For **Milwaukee**—Four through trains daily. Pullman Cars on night trains. Pullman parlor chair cars on day trains.

For **La Crosse, Wis., Winona and points in Minnesota**—One through train daily, with Pullman sleepers to Winona.

For **Dubuque** via **Freeport**—Two through trains daily, with Pullman Cars on night train.

For **Dubuque** and **La Crosse** via. Clinton—Two through trains daily, with Pullman cars on night train to McGregor, Iowa.

For **Sioux City** and **Yankton**—Two trains daily. Pullman cars to Missouri Valley Junction.

For **Lake Geneva**—Four trains daily.

For Rockford, Sterling, Kenosha, Janesville and other points you can have from two to ten trains daily.

MARVIN HUGHITT, General Manager.

L. F. BOOTH, Gen. Ea. Ag., 415 Broadway, N. Y. city.

W. H. STENNETT, General Passenger Agent.

CHICAGO, ROCK ISLAND & PACIFIC RAILROAD.

The direct route for Joliet, Morris, Ottawa, LaSalle, Peru, Henry, Peoria, Lacon, Geneseo, Moline,

ROCK ISLAND, DAVENPORT,

Muscatine, Washington, Iowa City, Grinnell, Newtown, Des Moines,

COUNCIL BLUFFS AND OMAHA,

Connecting with Trains on the Union Pacific Railroad for CHEYENNE, DENVER, CENTRAL CITY CORDEN, SALT LAKE, WHITE PINE, HELENA, SACRAMENTO, SAN FRANCISCO, and Points in Upper and Lower California, and with Ocean Steamers at San Francisco, for all points to

China, Japan, Sandwich Islands, Oregon and Alaska.

DEPOT, HEAD OF LA SALLE STREET; TICKET OFFICE, 56 CLARK STREET.

	LEAVE.	ARRIVE.
OMAHA AND LEAVENWORTH EXPRESS (Sundays excepted)	10.15 A. M.	4.00 P. M.
PEKIN ACCOMMODATION (Sundays excepted)	5.00 P. M.	9.35 A. M.
OMAHA AND LEAVENWORTH EXPRESS (Saturdays excepted)	10.00 P. M.	6.50 A. M.

KANSAS LINE.

The Chicago, Rock Island and Pacific Railroad Company have now opened their South Western Division, between

LEAVENWORTH, ATCHISON AND CHICAGO.

CONNECTING WITH KANSAS RAILROADS,

For all points in Western Missouri, Colorado and the Territories.

The Company have built a full complement of PALACE DRAWING ROOM AND SLEEPING CARS, which for external beauty and interior arrangements for the comfort, convenience and luxury of passengers, are unexcelled, if equaled, by any other cars of the kind in the world.

For Through Tickets and all desired information in regard to Rates, Routes, etc., apply at the Company's Offices, Chicago, or 257 Broadway, New York.

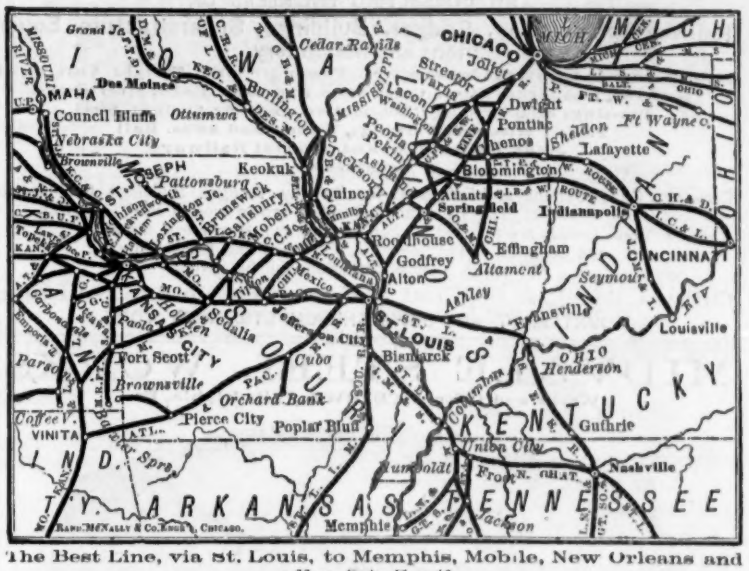
HUGH RIDDLE, Gen. Supt. A. M. SMITH, Gen. Pass. Agent.

CHICAGO, ALTON & ST. LOUIS

AND

CHICAGO, KANSAS CITY & DENVER

SHORT LINES.



The Best Line, via St. Louis, to Memphis, Mobile, New Orleans and all points South.

THE SHORT LINE TO TEXAS, VIA ST. LOUIS,

No change of cars on any train by this line between Chicago and St. Louis. Pullman Palace Sleeping Cars—the newest, safest and best in use on any road—run through between Chicago and Springfield and Chicago and St Louis without change. ***Meals in Dining Cars only 75 cents.*** No change of Reclining Chair Cars and Pullman Palace Sleeping Cars between Chicago and Kansas City. No extra charge for seats in Reclining Chair Cars. Two hours the quickest route from Chicago to KANSAS CITY, DENVER, PUEBLO and all points in Kansas and Colorado. No change of cars between Chicago and Peoria.

JAMES CHARLTON, General Passenger and Ticket Agent, Chicago.

J. C. McMULLIN, General Superintendent, Chicago.

ILLINOIS CENTRAL RAILROAD.

Trains Leave Chicago from the Great Central Depot, of Lake Street,

CHICAGO AND ST. LOUIS THROUGH LINE.

No Change of Cars to St Louis!

8.40 A. M. DAY EXPRESS. Sundays excepted. Arriving St. Louis at 8.45 P. M.

8.30 P. M. FAST LINE. DAILY. Arriving at St. Louis at 8.30 A. M

CAIRO, MEMPHIS, MOBILE AND NEW ORLEANS LINE.

No Change of Cars to New Orleans!

8.40 A. M. DAY EXPRESS, Sundays excepted, arriving at Cairo 2 20 A. M.; Memphis, 5.15 P. M.; Vicksburg, 10.10 A. M.; Mobile, 8.00 A. M.; and New Orleans at 11.45 A. M.

8.30 P. M. NIGHT EXPRESS. DAILY, tions for Arkansas and Texas.

4.30 P. M. GILMAN PASSENGER. Sundays Excepted. Arriving at Gilman at 8.50 P. M.

Arriving at Cairo 1 45 P. M., making direct connec-

This Route is from 100 to 175 MILES SHORTER and from 12 to 24 HOURS QUICKER than any other.

PEORIA, BURLINGTON AND KEOKUK LINE.

8.40 A. M. EXPRESS. Sundays excepted. Arriving at El Paso 2.30 P. M.; Peoria 3.50 P. M. Through coach from Chicago to Peoria

8.30 P. M. EXPRESS. Sundays excepted. Arriving at Peoria 3.10 A. M.; Burlington 7.45 A. M. Keokuk 8.15 A. M.; Hannibal 11.30 A. M. Sleeping cars from Chicago to Peoria and Chicago to Hannibal.

CLINTON AND SPRINGFIELD LINE.

8.40 A. M. DAY EXPRESS. Sundays Excepted. Arriving at Gibson 1.57 P. M.; Farmer City 2.57 P. M.; Clinton 3.48 P. M.; Springfield at 6.05 P. M.

8.30 P. M. NIGHT EXPRESS. Sundays excepted. Arriving at Gibson 12.30 A. M.; Farmer City 1.55 A. M.; Clinton, 2.38 A. M.; Springfield, 4.35 A. M.

DUBUQUE AND SIOUX CITY LINE.

9.30 A. M. DAY EXPRESS. Sundays Excepted. Arriving at Dubuque 7.00 P. M.; Waterloo, 12.05 A. M.; Fort Dodge, 5.35 A. M.; Sioux City, 12.32 P. M.

9.30 P. M. NIGHT EXPRESS. Sundays Excepted. Arriving at Dubuque 6.55 A. M.; Waterloo 12.05 P. M.; Fort Dodge, 7.00 P. M.; Sioux City, 7.10 A. M.

This is the only Route to Dubuque and Sioux City without Change.

For Tickets, Sleeping Car Berths and information, apply at the Illinois Central Railroad Ticket Office, 121 Randolph street, near Clark, and at the Central Depot, foot of Lake street.

W. P. JOHNSON, Gen. Pass. Agt. J. F. TUCKER, Gen. Supt.

ILLINOIS CENTRAL FREIGHT DEPARTMENT.

Freight taken for St. Louis, and points West and Southwest. For Hannibal and all points on the M. K. & T. R. R. For all landings on the Mississippi, Red and White Rivers, via Cairo and regular packets. The ONLY RAIL LINE TO MEMPHIS AND NEW ORLEANS, with

CARS RUN THROUGH WITHOUT CHANGE,

via the N. O., St. L. & C. R. R. and, by its connection at Frost, Tenn., the Direct Route to all points reached by the Green Line of the South; to Mobile, and points on the M. & O. R., via Jackson, Tenn., to Dixon, Freeport, Warren, Galena, Dunleith, and all landings on the Upper Mississippi during season of navigation, and without change of cars to Dubuque, Waterloo, Fort Dodge and Sioux City, Iowa; Vermillion and Yankton, Dakota Territory; and via Missouri Packets to points on the Upper Missouri.

Bills Lading and Rates furnished upon application at 121 RANDOLPH street, or foot of South Water street.

HORACE TUCKER, General Freight Agent.

WISCONSIN CENTRAL RAILROAD.

GARDNER COLBY, Pres., Boston, Mass. E. H. ABBOTT, Treas., Boston,

Built and operated by Phillips & Colby Construction Company. E. B. Phillips, Pres. and Gen. Manager Milwaukee; Charles L. Colby, Vice-Pres. and Land Commissioner, Milwaukee; E. Bacon, Superintendent, Milwaukee; Henry Pratt, Auditor and Gen. Ticket Agent, Milwaukee.

OFFICES: Milwaukee, Wis., and 28 State Street, Boston, Mass.

SHORT LINE TO GREEN BAY, the WISCONSIN and CHIPPEWA PINERIES, ASHLAND and BAYFIELD, LAKE SUPERIOR, Via MENASHA and STEVENS POINT.

TWO DAILY TRAINS FROM MILWAUKEE FOR MENASHA AND GREEN BAY.

ONE TRAIN FOR STEVENS POINT, WAUPACA, AMHERST, GRAND RAPIDS, PLOVER, PLAIN FIELD, COLBY, MEDFORD, PHILLIPS, FIFIELD AND ASHLAND.

Through Sleeping Cars on 9:30 p. m. train from Chicago (C., M. & St. Paul Depot), and from Milwaukee on 1:30 a. m. train for Green Bay, Menasha and Stevens Point. Sleeping car at Milwaukee ready at 8:30 p. m.

ELEGANT NEW CARS HAVE BEEN ADDED. Price of berth only $1 50.

CONNECTIONS: At Milwaukee, with Chicago, Milwaukee & St. Paul, and Western Union Railways; at Plymouth, with Sheboygan & Fond du Lac Railroad, for Fond du Lac and Sheboygan; at *Forest Junction*, with Milwaukee, Lake Shore & Western Railway; at Green Bay, with Green Bay & Minnesota Railway, for New London, and Chicago & Northwestern Railway, for points North; at Dale, with fast stage line for New London; at Amherst Junction, with Green Bay & Minnesota Railway, for Grand Rapids and points West; at Junction City, with Wisconsin Valley Railway, for Wausau; at Portage with C., Mil. & St. Paul Ry., for Madison and the West.

R. E. RICKER, Civil and Mechanical Engineer.

R. E. RICKER & CO.,

GEO. S. JONES.

GENERAL RAILWAY AGENCY

AND CONSULTING ENGINEERS ON

Railway Construction, Bridges, Buildings, Superstructure, Equipment and Machinery,

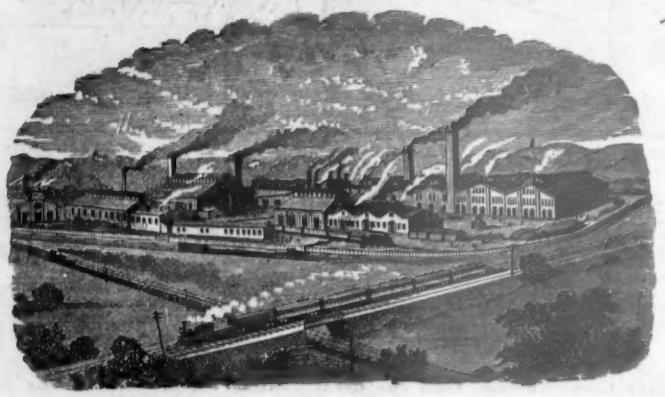
Manufacturer's Agents for Locomotives, Passenger and Freight Cars of all patterns, and Steam Street Cars; Steel and Iron Rails, Steel Frogs, Crossings and Switches; Locomotive and Car Springs, Steel Tires, Plates and Forgings, Wheels and Axles, Rail Joint Fastenings, and General Railway Machinery.

Drawings, Specifications and Estimates for Railway Bridges, Buildings, Locomotives and Cars. Personal Supervision and Inspection given work during construction. Orders are solicited for general Railway Machinery, Materials and Supplies, to the Selection, Purchase and Forwarding of which special attention will be given.

Offices, 34, 35 & 36 Coal and Iron Exchange Building, COURTLANDT AND NEW CHURCH STS., NEW YORK.

MIDVALE STEEL WORKS.

Works and Office, NICETOWN, Philadelphia, Pa.



MANUFACTURERS OF

Crucible and Open Hearth Steel,

el Locomotive Tires, Steel Axles of Every Description, Steel Forgings, up to 8,000 lbs. in Weight, Solid Steel Castings, Hammer Dies, Frogs, &c. Best Tool, Machinery and Spring Steels.

WM. SELLERS, Pres. MARRIOTT C. SMYTH, Sec'y and Treas. CHAS. A. BRINLEY, Sup't.

Engineers' and Surveyors' Instruments.

MEDAL AWARDED—Exhibition of All Nations, New York, 1853, for best Drawing Instruments. Particular mention for Limb Protractors.

MEDAL AWARDED—International Exhibition, Philadelphia, 1876, for Surveying and Leveling Instruments.

JAMES PRENTICE, 164 Broadway, N. Y.

ESTABLISHED 1820.

PATENT TRANSITS

W. J. YOUNG & SONS,

Engineering Instrument Makers,

43 NORTH SEVENTH STREET,

Philadelphia.

Tapes, Chains, Draughting Instruments. Catalogues on application.

ESTABLISHED 1848.

WILLIAM SELLERS & CO.

PHILADELPHIA.

Machine and Railway Shop Equipments, Turn Tables, Pivot Bridges, Shafting, Etc.

GIFFARD'S INJECTOR—SELLERS' IMPROVEMENTS.

NEW PATTERNS, SIMPLE, EFFECTIVE.

No. 2, 10 H. P., $18.	No. 3, 25 H. P., $25.	No. 4, 45 H. P., $35.	No. 5, 70 H. P., $45.	No. 6, 100 H. P. $55.	No. 7, 140 H. P., $65.	No. 8, 190 H. .. $75.	No. 10. 275 H. P. $95.

Send for circular giving particulars.

Branch Office, 79 Liberty Street, New York.

JUST PUBLISHED:

"RAILWAY DISBURSEMENTS

And the Accounts into which they are Naturally Divided."

BY MARSHALL M. KIRKMAN.

This work is intended to give full and minute instructions for the guidance of those agents and employes of railroad companies who may be entrusted with the disbursing of the money or material of the corporation, in such manner as to insure the strict accounting for everything, leaving no loop-holes for undetected waste or wrongful appropriation of the company's property.

The book consists chiefly of formal rules, illustrated by forms of the blanks recommended and referred to. These rules are the result of many years' experience, most of them having been practically applied and amended from time to time as seemed advisable to make them thoroughly effective and perfectly clear. It is believed that they will be, for the most part at least, found applicable on all American railroads, and can be issued as instructions to employes accordingly.

The most complete and exact rules for keeping railroad accounts ever published. Price $2, postage paid. Published by the RAILROAD GAZETTE, 73 Broadway, New York.

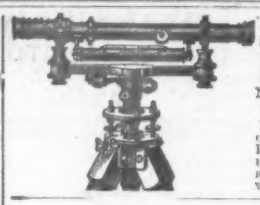
HELLER & BRIGHTLY, Engineering and Surveying Instruments, 33 N. Seventh St., Phila

Without decreasing size of any part of our "Engineers' Transit" we have reduced the weight one-half. An ordinary Transit Telescope magnifies from 10 to 12 diameters, our new Transit Telescope (length 10½ inches, shows objects erect and not inverted) magnifies 28 diameters and will read time on a watch-dial at 983 feet. For description of our new Mining Transit (weight 5¼ lbs.) and Plummet Lamp, see Van Nostrand's Engineering Magazine, June, 1873.

Extract from report of Committee of Civ. Engrs. appointed by Franklin Inst. to examine H. & B.'s new Transit [Dec., 1871]: "It exhibits several novelties of construction which, in the opinion of the committee, render it superior to those now in use, and in its opinion the deviations which they have made from the common styles of Transit are decided improvements."

JOHN C. TRAUTWINE, Chairman.

Descriptive and Illustrated Price List sent Post-paid on Application.



N. KUEBLER, Engineering Instrument MANUFACTURER, No. 925 Sansom st. Philadelph'a

I call the attention of Engineers to my Patented Improvement on Telescopes and Patented Universal Theodolite.

BUFF & BERGER'S

Large Illustrated Catalogue and Manual of Improved ENGINEERS' and SURVEYORS' FIELD INSTRUMENTS, of their manufacture, is now ready and will be sent, Post-paid, on receipt of 75 cents. Price List free, on application. BUFF & BERGER, Manufacturers of Engineers' and Surveyors' Instruments, No. 9 Province Court, Boston, Mass.

VALENTINE & COMPANY,

VALENTINES VARNISH

333 PEARL STREET, NEW YORK.

BOILER PUNCHES.

A SPECIALTY.

IMPROVED RAILWAY CAR STOVE.

CHILSON'S PATENT CONE DISK STOVE.

Remodeled and Greatlv Improved 1876, Including Chilson's Anti-Clinker Grate and Locks on the Doors.

I claim for this Stove SAFETY, ECONOMY, DURABILITY, SIMPLICITY, CLEANLINESS AND BEAUTY OF DESIGN.

In the use of several thousands of this Superior Stove they have proved to be the only Stove ever made that THOROUGHLY WARMS THE CAR FLOOR. The new combination of fire pot, cone radiator and broad radiating disks prevents the heat from first rising to the upper part of the car, but radiates, deflects and throws the heat downward, making the car COMFORTABLY WARM, ESPECIALLY FOR THE FEET, instead of the floor cold and the heat overhead, as with other stoves used for car warming. I claim for it the following:

1st. It is perfectly safe, being well secured against ACCIDENTAL FIRES BY BEING BOLTED DOWN TO THE FLOOR AND HAVING LOCKS ON THE DOORS, SO THAT IN CASE A CAR SHOULD BE OVERTURNED, FIRE COULD NOT GET OUT OF THE STOVE. The guard rail, which supports the feet when warming them, also serves as a fender, preventing the clothing from coming in contact with the Stove.

2d. There is no hearth for dirt, filth and tobacco spittle to accumulate on, which insures CLEANLINESS AROUND THE STOVE.

3d. This Stove keeps the fire through the season, and although adapted for coal, yet wood can be burned in it equally well.

It will be highly appreciated by all in want of a superior heater for factories, stores, offices, railroad cars and station houses, school rooms, workshops, etc., and has especially proved itself to be the most successful plan yet devised for warming Railroad Cars.

Bolts are not used except for Railway Cars and Steamboats.

The following are among the many testimonials from Railroad Managers, in favor of this Stove:

BOSTON & PROVIDENCE RAILROAD CORPORATION, Superintendent's Office, Boston, April, 1876.

GARDNER CHILSON, Esq.:

Dear Sir—We have about three hundred of your patent "Cone" Disk Stoves in use (a part of them for nearly six years), for warming Passenger Cars and Stations. I can truly say that they have given entire satisfaction. These Stoves possess many important advantages over any other we have ever used, viz.: for WARMING THE FLOOR AND DISPLACING THE COLD AIR IN THE LOWER PART OF THE CAR, WHEREBY THEY ARE RENDERED MUCH MORE COMFORTABLE, ESPECIALLY FOR THE FEET, THAN BY ANY OTHER PLAN KNOWN TO US. The Stove is more economical in the consumption of fuel, more substantial in construction, and consequently requiring less repairs than any other in use, and so securely constructed as to prevent fire from getting out of the Stove, even should the car be OVERTURNED.

I cheerfully give my testimony in favor of this Stove, and commend it to all Railroad Managers.

Yours, &c.,

A. A. FOLSOM, Superintendent.

W. E. CHAMBERLAIN, Master Car Builder.

BOSTON & ALBANY RAILROAD (Boston Division), Car-Shop Office, Allston, Mass., April, 1876.

GARDNER CHILSON:

Dear Sir—We have now a large number of your Cone-Disk Stoves in use, for warming Passenger Cars and Stations, some of them for quite a number of years. We have had the very best success with these Stoves, giving perfect satisfaction in every way. They are substantially made, and require less repairs than any other stove in use that I am acquainted with. I can cheerfully recommend it as the best Stove now in use for Railroad service.

Yours truly,

W. E. CHAMBERLAIN

Numerous other testimonials, received from Railroads and other persons having these Stoves in use in Halls, Stores, etc., may be seen at office.

Also, Chilson's Wrought or Plate-Iron Furnace, The Centennial, 1876.

This superb Furnace will show the greatest improvements yet made in wrought or plate-iron furnaces, including CHILSON'S Anti-Clinker Grate, decidedly the best plan ever seen for removing clinkers and keeping a continuous fire, ensures a large SAVING OF FUEL, and simplifies and lessens the work of attending the furnace. It has my Shifting Grate, which moves on rollers and dumps.

Special attention is directed to the important improvement made in 1876 in my well-known STANDARD CONE FURNACE, including my Anti-Clinker Grate, the most important improvement ever made for removing clinkers and keeping a Continuous Fire, also insuring a large Saving in Fuel. It also simplifies and lessens the work of attending the Furnace. This celebrated Furnace has had no rival since its first introduction, and with the improvements of 1876 it will be more appreciated than ever before. Now more than 30,000 in use Also

THE ARLINGTON.

My entirely new and greatly improved PORTABLE RANGE, 1876. Every housekeeper should see this range, whether they wish to purchase or not. Also my new and very splendid ARLINGTON BRICK SET RANGE, the best and handsomest work ever seen in any kitchen. Also COOKING and PARLOR STOVES, GRATES, etc. Special attention paid to putting up Furnaces and Ranges in any part of the country. Nothing but what is strictly first-class ever manufactured by me.

Warerooms, 99 and 101 Blackstone St., Boston. Foundry at Mansfield, Mass.

GARDNER CHILSON.